BLUE JAY

Volume 63 Number 2 June 2005

Blue . conservation for Saskatchewan and adjacent regions. It is published quarterly by **Nature Saskatchewan, 206-1860 Lorne Street, Regina, Saskatchewan S4P 2L7.**

CN ISSN 0006-5099

EDITORIAL INFORMATION: *Blue Jay* welcomes all submissions, hand-written or typed, polished or in need of editorial assistance. All items for publication should be addressed to the editors. Deadlines for text for each issue are two months prior to issue, i.e. 1 January, 1 April, 1 July and 1 October. Deadlines for photographs are one month later. Please include the author's telephone number or E-mail address for editorial contact. Hand-written or typed manuscripts should be submitted in duplicate. Manuscripts can also be submitted in electronic form, either on a 3.5" diskette or by E-mail in WordPerfect, Microsoft Word, Rich Text Format (rtf) or ASCII text. Send images separately. For further information, see "Guidelines for Authors" in this issue of *Blue Jay*, Vol. 62 (3). R. W. Nero and J. R. Duncan abstract *Blue Jay* for *Recent Ornithological Literature*. *Blue Jay* is abstracted by BIOSIS.

Common names are used for birds, mammals and butterflies. Bird names follow the Checklist of North American Birds by the American Ornithologists' Union (7th edition, 1998); mammal names, Mammal Species of the World by Wilson and Reeder; butterfly names, The Butterflies of Canada by Layberry *et al*. For other groups, both scientific and common names are included.

Photographs may be submitted as prints, slides or digital images. For the best quality reproduction on paper, high resolution (600 DPI) images are required, preferably in TIF format. JPG files and images with a lower resolution are also acceptable and provide sufficient quality in many cases. Digital images can be sent by e-mail directly to the editors, or if the files are very large, they should be put on a CD and mailed to the editors' postal address.

Although Nature Saskatchewan will make every effort to return your slides and prints to you, we recommend that you make a copy for your records in case your items get lost in the mail. We encourage submission of photographic material with articles and we welcome colour photos for *Blue Jay* covers.

Any material printed in *Blue Jay* may be reprinted for non-commercial purposes, without permission, but credit lines are both appreciated and good etiquette. Use of photographs and poetry requires permission from the photographer/author.

REPRINTS: a maximum of five reprints is available to authors free of charge for each article. Authors wishing to receive reprints should send their request, along with a stamped ($.98) self-addressed, 5 3/4 x 9 1/2 in. kraft envelope to the Nature Saskatchewan office as soon as they receive notice that their article is accepted for publication.

SUBSCRIPTIONS: Subscription to *Blue Jay* is one of the benefits of membership in Nature Saskatchewan. A membership application form is included on the last page of each issue. Send all renewals, new memberships, donations and changes of address to Nature Saskatchewan (address at top).

Bulk subscription orders (minimum of five to one address) are available to society members and educational institutions at the rate of $15 (Can.) for the first subscription and $13 for each additional one. Outside Canada, fees are $18 (Can.). We do not collect GST on memberships or subscriptions.

COVERS: Front - Aquatic macroinvertebrates from Crooked Lake Fen Nature Sanctuary. Photograph by Dale Parker. See article on page 98 and picture key on page 108.
Back - Flowering Rush (*Butomis umbellatus*) in full flower north of Minaki, Ontario. Photograph by Glen McMaster

Printed by Administration Centre Printing Services, Regina, Saskatchewan on 10% recycled paper.

THIS ORGANIZATION RECEIVES FUNDING FROM Saskatchewan LOTTERIES

Blue Jay

Vol. 63 No.2 June 2005 65-118

CONSERVING HABITAT THROUGH VOLUNTARY STEWARDSHIP: DOES IT WORK?

MARGARET A. SKEEL and ROBERT G. WARNOCK. Nature Saskatchewan, 206-1860 Lorne Street, Regina, SK S4P 2L7. E-mail: <mskeel@naturesask.com>, <warnockr@accesscomm.ca>

Introduction

Conserving natural habitats is a priority for maintaining the biological diversity that sustains the natural processes upon which all living creatures depend. A number of strategies with varying levels of security and costs are being used to attain this goal, including voluntary habitat stewardship agreements, conservation easements, and land acquisition. Using Operation Burrowing Owl (OBO) as an example, we undertook a study to evaluate whether voluntary habitat stewardship agreements can be an effective strategy to conserve habitat.

What is voluntary habitat stewardship? It generally includes a "handshake" agreement–one that is not legally binding–between the landowner and a conservation organization to preserve or enhance natural habitat. It involves a personal commitment from the landowner, but no change in ownership of the land. In OBO, these are signed agreements and are indefinite in duration (they usually last until cancelled by the landowner). Although not legally binding, voluntary stewardship agreements do provide an opportunity for the conservation organization to strengthen the commitment of the landowner. This is accomplished by raising awareness of the elements of biologically diverse natural habitats and the value of biodiversity to ecosystem stability and the landowner's operation. In recognition of their participation, landowners may receive gate signs, certificates, educational materials, newsletters and extension services. In some cases, landowners also receive financial incentives for habitat enhancement; this usually involves an agreement to maintain the enhanced land for a designated period of time.

OBO was initiated in 1987 to address the rapid disappearance of grassland habitat and Burrowing Owls in Saskatchewan. Currently, only 20% of former grasslands remain as natural habitat, and in highly arable areas only 2% remain.[3] Because most native prairie is privately owned, conservation initiatives largely depend on, or are driven by, landowners. Habitat loss and change, including fragmentation, and the associated low productivity and high mortality, have been identified as primary causes contributing to the Burrowing Owl's decline.[1, 10] In OBO, landowners who have Burrowing Owls nesting on their land join the program, and continue to participate in OBO even if owls do not return to nest. The works of Hjertaas and Skeel et al. fully describe the OBO program.[4, 8]

Performance evaluation of conservation programs is needed to determine and improve their effectiveness.[6] Until recently, voluntary stewardship programs have not been evaluated for their effectiveness in conserving habitat. In addition, direct

evaluation of habitat conservation programs through comparison with historical data sets is rare, but increasingly important. Using a historical data set as a control sample, we examined whether the OBO program, one of the longest running voluntary habitat stewardship programs in Canada, has achieved conservation of grassland habitat.[5] Our work is summarized here. The complete report has been published elsewhere.[12]

Study area and methods

Our study area was located in southern Saskatchewan, represented by the Weyburn (62E) and Regina (72I) 1:250,000 map areas of the National Topographic Survey of Canada. This is the same area from which the control dataset was derived.[5] We compared OBO parcels and randomly-selected parcels of land that were grassland in 1986 with land use in 1993 to determine if grassland retention was greater at OBO sites. Our sample was the 108 private grassland parcels enrolled in the OBO program in 1987-1988, and 98 of the 882 grassland parcels surveyed by Hjertaas and Lyon that

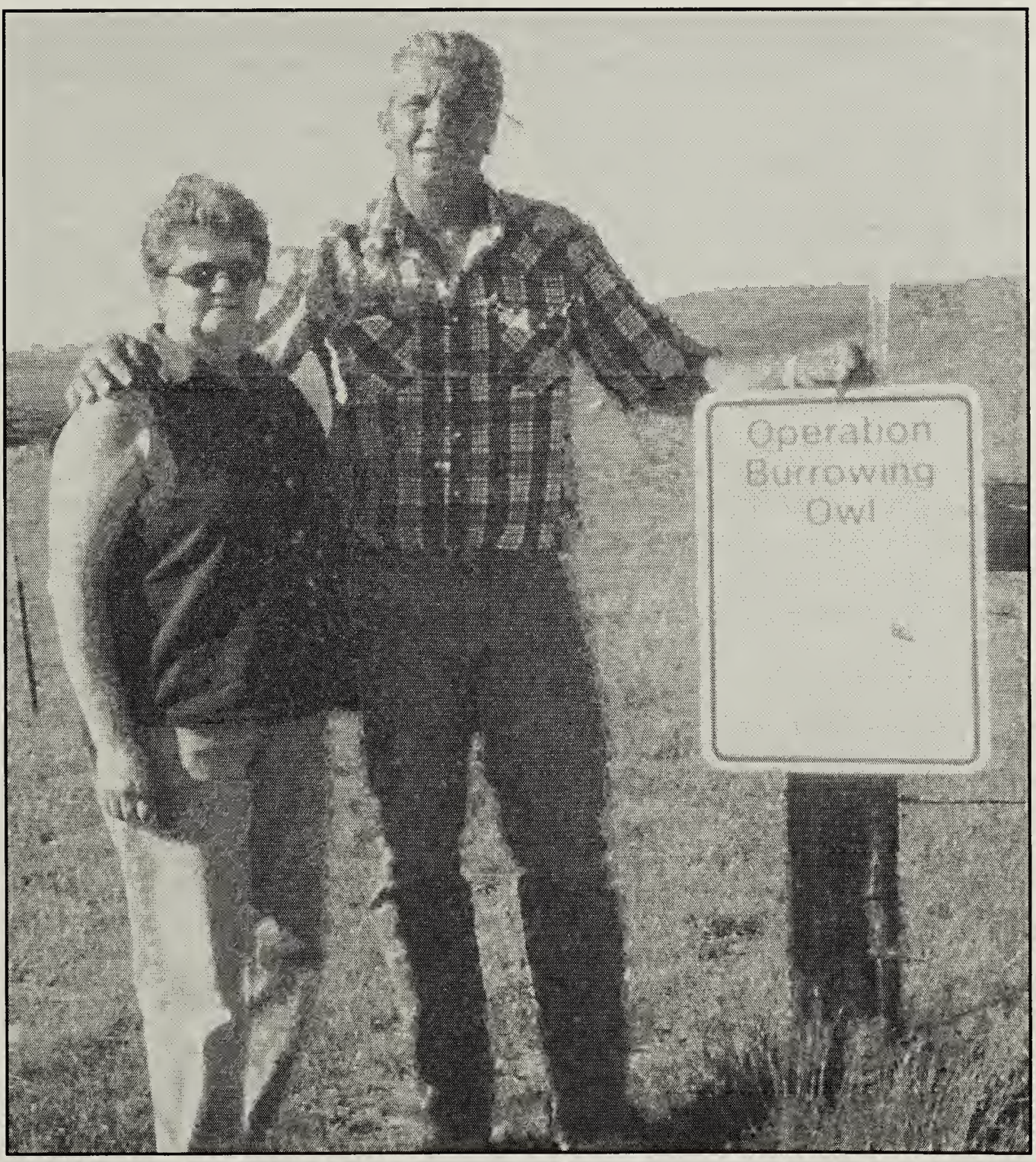


Figure 1. Voluntary Habitat Stewardship at work: Glenn and Josie Pettersen and their OBO sign ***Kim Dohms***

were systematically selected as random sites. These randomly-selected sites were all privately owned, were not known to support Burrowing Owls and had similar habitat and soil types as OBO sites.

All OBO and randomly-selected sites were assigned to one of three parcel size classes: less than 2 ha (5 acres), 2-12 ha (5-30 acres), and greater than 12 ha (30 acres), following Hjertaas and Lyon.[5] Each site was also assigned to one of three agricultural soil suitability classes based on a combination of land system and soil type.[2, 7, 9] Land use in 1993 at all sites was determined from satellite (LANDSAT) imagery using 1992 and 1993 Southern Saskatchewan Digital Land Cover Maps. Verification of a sample of 96 OBO and randomly-selected sites suggested an accuracy of 78% even with the seven-year time lag, and it improved our estimated accuracy to 88%. A correction factor for the apparent bias of the digital land cover data to underestimate the extent of grassland was used to adjust grassland retention for 21 sites.

Results and discussion

Grassland retention rates

Our study showed that grassland conservation was significantly higher at Operation Burrowing Owl sites than at the randomly-selected sites. At OBO sites 66% of the grassland area present in 1986 was still grassland in 1993. At randomly-selected sites, only 49% of the 1986 grassland was still present. These retention rates were for all parcel size and agricultural soil suitability classes combined.

When parcel size and agricultural soil suitability classes are looked at, it becomes apparent that OBO was important to grassland conservation at sites that were at greater risk from cultivation: i.e., at smaller grassland parcels (12 ha or less) and grassland parcels with excellent to average agricultural soils (Table 1). Grassland retention at these high-risk sites was significantly higher at OBO sites than at randomly-selected sites. Grassland retention did not differ between OBO and randomly-selected sites at the larger sites or sites with poor soils. At randomly-selected sites, smaller parcel sizes and better agricultural soils experienced higher loss to cultivation.[12] At OBO sites, grassland retention was uniformly relatively high and parcel size or agricultural soil suitability was not a significant factor.[12]

Smaller parcels were at a greater risk, perhaps because they are logistically easier to cultivate or they may be considered to be of little economic value as grassland to the

Table 1: Grassland Retention at Operation Burrowing Owl and Randomly-Selected Sites from 1986 – 1993.

	OBO Sites		Randomly-Selected Sites		
	Average Retention	Number of Sites	Average Retention	Number of Sites	P
All Sites	**66%**	108	**49%**	98	**0.005**
For Parcel Size Classes					
<2 ha	**69%**	25	**23%**	29	**<0.001**
2-12 ha	**62%**	36	**38%**	36	**0.031**
> 12 ha	68%	47	82%	33	0.113
For Agricultural Soil Suitability Classes					
Excellent	**54%**	34	**25%**	33	**0.007**
Average	**76%**	52	**49%**	41	**0.004**
Poorest	63%	22	80%	24	0.166

[a]Bold indicates significantly different means.

landowner. Better agricultural soils were also at greater risk of cultivation. Although larger grassland parcels (>12 ha) and grassland parcels with poor agricultural soils were at lower risk from cultivation, future changes in agricultural practices and climatic and economic conditions (government policies, crop prices) could contribute to changes in the risk from cultivation of these grassland sites.

Conservation through voluntary stewardship

Voluntary stewardship through the OBO program was successful in conserving grassland habitat, and in particular at the sites most at risk. The Burrowing Owl itself, both as a conservation focus and as a means to increase awareness by landowners, may have contributed to the success of the OBO program. A charismatic species such as the Burrowing Owl can serve as a conservation symbol to motivate conservation at many levels.[13] Thus, conservation actions to maintain nesting owls (and other wildlife that might serve as conservation symbols) on the landscape may be important, as the presence of such wildlife encourages landowner commitment. Conservation actions to aid in the recovery of the endangered Burrowing Owl would include maintaining grassland habitat, focusing on vulnerable sites and sites that are most valuable to owls to attain highest productivity. Higher productivity may be encouraged through reducing fragmentation, as promoted through OBO habitat enhancement activities with landowners (seeding cultivated land that is adjacent to grassland back to perennial cover), and retaining wetlands (a source of prey species) nearby to nesting pairs.[10, 11]

Conclusions

The Operation Burrowing Owl voluntary stewardship program had a significant impact on conservation (retention) of grassland habitat at enrolled sites, and even during an era of accelerated grassland loss in the area (the number of grassland parcels lost increased from 23% during 1979-1986 to 42% during 1987-1993). Voluntary stewardship agreements are a low-cost conservation tool and, when warranted by risk assessment and cost, potentially can be scaled into a higher level of security such as a conservation easement. Does voluntary stewardship work? Can it achieve the desired conservation goals? Our study strongly suggests that it can.

Acknowledgements

Operation Burrowing Owl has been successful through the dedicated efforts of many individuals. We wish to thank participating OBO landowners, OBO volunteers, Nature Saskatchewan staff and summer students, and other conservation agencies including the Saskatchewan Watershed Authority and Saskatchewan Burrowing Owl Interpretive Centre. In addition, we thank again the people and organizations that assisted with the OBO effectiveness study.[11] We are grateful for recent funding support from Canadian Council for Human Resources in the Environment Industry - Environmental Youth Program, Elsa Wild Animal Appeal of Canada, Environment Canada - EcoAction, Government of Canada Habitat Stewardship Program for Species at Risk, Human Resources Development Canada - Summer Career Placement Programs, Nature Saskatchewan member donations, SaskEnergy - TransGas, Saskatchewan Environment - Fish and Wildlife Development Fund, and World Wildlife Fund & Environment Canada - Endangered Species Recovery Fund. Nature Saskatchewan receives funding from Saskatchewan Lotteries.

1. CLAYTON, K.M. AND J.K. SCHMUTZ. 1999. Is the decline of Burrowing Owls *Speotyto cunicularia* in prairie Canada linked to changes in Great Plains ecosystems? *Bird Conservation International* 9: 163-185.

2. FLORY, P.M. 1980. Terrestrial wildlife habitat inventory of the Regina (72 I) map area. Saskatchewan Tourism and Renewable Resources, Wildlife Technical Report 80-1, Regina, Saskatchewan.

3. HAMMERMEISTER, A.M., D. GAUTHIER and K. MCGOVERN. 2001. Saskatchewan's Native Prairie:

Taking Stock of a Vanishing Ecosystem and Dwindling Resource. Native Plant Society of Saskatchewan Inc., Saskatoon, Saskatchewan.

4. HJERTAAS, D.G. 1997. Operation Burrowing Owl in Saskatchewan. Pages 112–116 *in* J.L. Lincer and K. Steenhof, editors. The Burrowing Owl, its biology and management: including the proceedings of the first international symposium. Raptor Research Report No. 9.

5. HJERTAAS, D.G. and W. LYON. 1987. A Stratified Random Survey for Burrowing Owls on the Weyburn (62E) and Regina (72I). Map Areas. Saskatchewan Parks, Recreation and Culture, Wildlife Technical Report 87-2, Regina, Saskatchewan.

6. KLEIMAN, D.G., R.P. READING, B.J. MILLER, T.W. CLARK, J.M. SCOTT, J. ROBINSON, R.L. WALLACE, R.J. CABIN and F. FELLEMAN. 2000. Improving the evaluation of conservation programs. *Conservation Biology* 14:356-365.

7. MITCHELL, J., H.C. MOSS and J.S. CLAYTON. 1944. Soil Survey of Southern Saskatchewan Townships 1 to 48 Inclusive. University of Saskatchewan, Soil Survey Report No.12, Saskatoon, Saskatchewan.

8. SKEEL, M.A., J. KEITH and C.S. PALASCHUK. 2001. A population decline of Burrowing Owls in Saskatchewan documented by Operation Burrowing Owl. *Journal of Raptor Research* 35: 371-377.

9. STELFOX, H.A. 1979. Terrestrial Wildlife Habitat Inventory of the Weyburn (62E) – Virden (62F) Map Area. Saskatchewan Tourism and Renewable Resources, Wildlife Technical Report 79-6, Regina, Saskatchewan.

10. WARNOCK, R. 1997. Is habitat fragmentation a factor in the decline of the Burrowing Owl in Saskatchewan? *Blue Jay*: 222-228.

11. WARNOCK, R.G. and M.A. SKEEL. 2002. Habitat features important to Burrowing Owl breeding success in Saskatchewan. *Blue Jay*: 135-145.

12. WARNOCK, R.G. and M.A. SKEEL. 2004. The effectiveness of voluntary habitat stewardship in conserving grassland: Case of Operation Burrowing Owl in Saskatchewan. *Environmental Management* 33: 306-317.

13. WILSON, E. O. 1992. Biodiversity of Life. W.W. Norton, New York, NY, USA.

NORTHERN FLICKER

Yellow-hammer foraging
drums the earth for ants
scarlet crescent on his nape
top of head a gray
side of head vinaceous tan
and moustache of black

spotted breast a salmon-buff
with a dark cravat
back and coverts olive-brown
barred with dusky jet
rump a bar of showy white
underbody beige

under side of wings and tail
golden gilt or yellow
what a smart *le pic doré*
what a handsome fellow

- Victor C. Friesen

BIRDS

NORTHERN SAW-WHET OWL NEST BOX MONITORING

CHUCK PRIESTLEY, BRYN SPENCE and LISA PRIESTLEY, Beaverhill Bird Observatory, P.O. Box 1418, Edmonton, AB T5J-2N5

Introduction

Many studies have been conducted on secondary cavity nesting species using nest boxes. Most of these studies, however, have involved songbirds. We found only nine published accounts on nest box monitoring of Northern Saw-whet Owl (hereafter referred to as Saw-whet) and none of these studies was conducted north of Naramata (49°35.9'N, 119°35.6'W), British Columbia.[1,2,4,6,7,8,9,12,13] Information on the breeding biology of the Saw-whet at the northern part of its range is essentially unknown.

Nest boxes are used to monitor wildlife populations because they are easy and

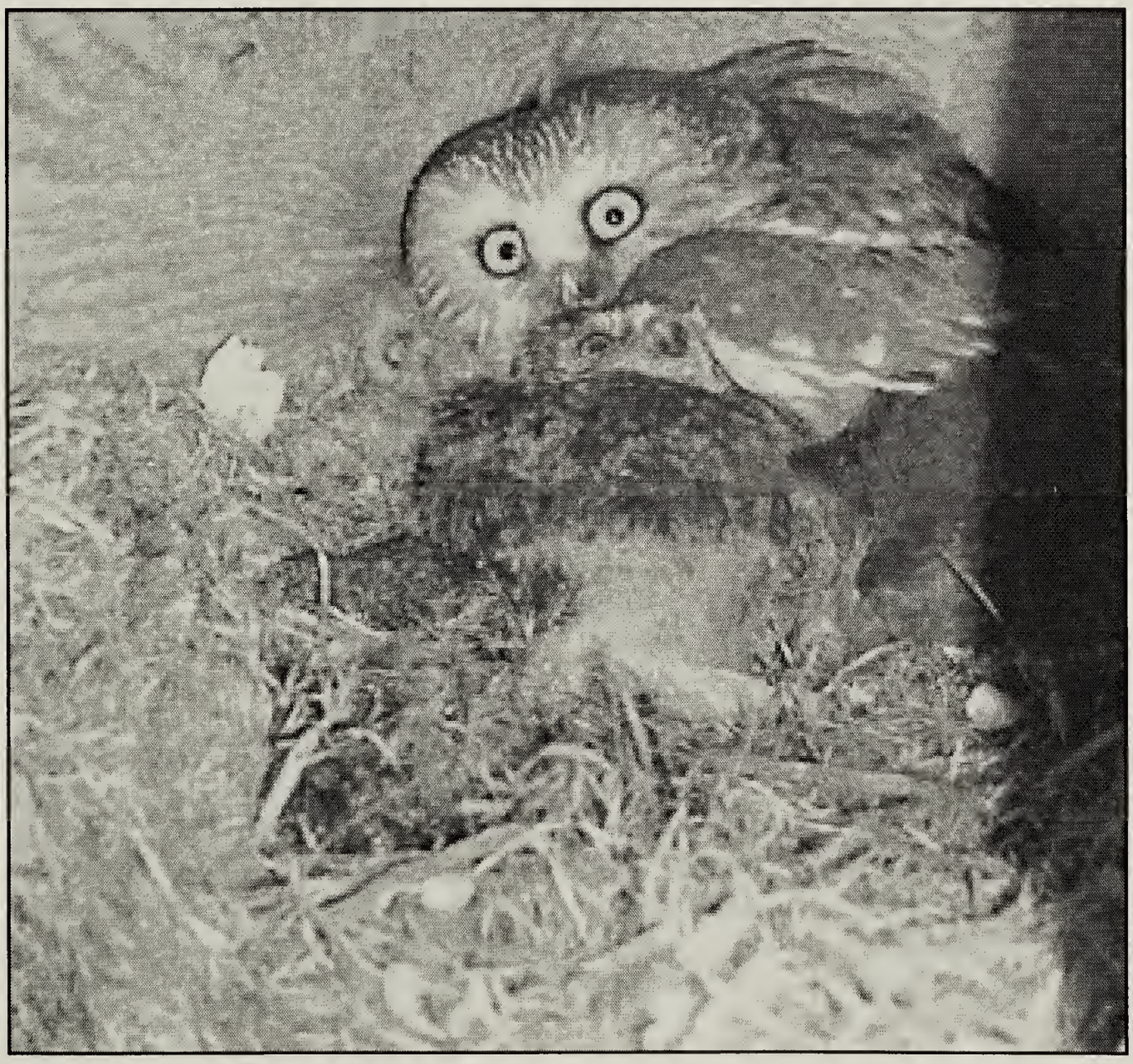


Figure 1. Northern Saw-whet Owl in nest box ***Lisa Priestley***

relatively inexpensive to construct. In addition, when analyzing nest box occupancy rates to determine population abundance trends, researchers are able to factor out monitored nest presence, size, shape and condition when considering reproductive output variables.[14,17] A nest box project also provides insight about other variables that limit reproductive success such as prey and roosting habitat availability.

Saw-whets are suitable subjects for a nest box monitoring program because they are at a high trophic level and therefore changes in their abundance could indicate changes to the larger ecosystem. Secondly, the Saw-whet is one of the most common raptor species in Canada[3] and can therefore provide the large sample size that makes it possible to detect population abundance trends with statistical significance. Finally, Saw-whet projects garner a great deal of public interest and financial support which increases the likelihood that they will receive the long-term support essential to the implementation of community and environment-based management policies, practices and programs.[10] In order to understand how Saw-whet populations change, nest box monitoring and nocturnal calling surveys have to be considered in conjunction with surveys done for this species during migration and winter monitoring efforts.[16]

The intention of this paper is to report on the first year of our nest box monitoring project. We also provide a detailed nest box design for people interested in building Saw-whet nest boxes and participating in Saw-whet nest box monitoring projects.

Methods

We put up 50 nest boxes in the study area, a 1,965km^2 rectangle with Edmonton (53°32.7'N, 113°29.4'W), Tofield, Camrose and Millet at the four corners.

Twenty boxes were put up in Ministik Lakes Game Bird Sanctuary in the middle of the study area. The Ministik area consists of forest interspersed with lakes and ponds. Thirty boxes were put up outside Ministik in an area dominated by agricultural and acreage developments interspersed with residual forest patches.

Boxes were numbered and put up in mixedwood forests of Trembling Aspen (*Populus tremuloides*) and White Spruce (*Picea glauca*). Boxes were placed only in areas where natural Saw-whet nests could occur as indicated by Pileated Woodpecker holes in large-diameter trees.

Nest boxes were put up between 25 January and 19 February 2004. GPS coordinates for each nest were recorded when boxes were put up. Boxes were placed 12ft above the ground and a 10-foot ladder was used to put up and check boxes. Nest hole orientation was southeast so that it was on the leeward side of the prevailing wind. Boxes were put up in pairs. The distance between each box in a pair was 30-60m.

Boxes were checked for occupancy in early April, early May and early July.[3] Boxes were always opened when they were checked to ensure that owls would be detected even if they were reluctant to emerge from the nest. When checking boxes or visiting occupied boxes the following information was recorded: box number, visit number, date, time, purpose of visit, distance of the observer from the nest before owl emergence, number of eggs, number of juveniles and prey items in the nest.

Information on sex (based on presence or absence of a brood patch or cloacal protuberance[11]), age[11], unflattened wing chord, tail length and weight was recorded for all Saw-whets at occupied nests. Females were caught in a small fishing net on the end of a painting pole held over the nest hole and males were caught using a modified version of the Saurola trap.[15] The Saurola trap is a box with a trap door at one end. This trap,

which is placed in front of the nest hole, intercepts the male when he is delivering prey to the female. In addition, when trapping males with the Saurola trap, we noted any prey items that were delivered.

Results

During 2004, Saw-whets attempted to breed at five nest boxes. For the purposes of this study, we considered a Saw-whet nesting attempt to be the laying of at least one egg. A breeding attempt was considered successful when young fledged. Four of the five Saw-whet nesting attempts were successful. The young in the fifth nest box hatched but died prior to fledging. Seven young fledged from one nest box and five fledged from each of the other three. The average number of Saw-whet young produced per nesting attempt was 4.4 (n=5, SE=1.17) and the number of Saw-whet young that fledged per successful breeding attempt was 5.5 (n=4, SE=0.500).

There were two occasions when Saw-whet presence in a nest box did not lead to a nesting attempt. In the first case, a Saw-whet stuck its head out of a nest box while two observers approached. When researchers returned to the nest, the box was empty. In the second case, two Deer Mice and two Red-backed Voles were found in a nest box. We assumed that these prey items were brought by a male Saw-whet to entice a female to use the nest box.

Fifteen of the 50 nest boxes were used by squirrels. Red Squirrels were found at eight nest boxes. Northern Flying Squirrels were found at one nest box. Squirrel nesting material was found at an additional six nest boxes but we were unable to identify the species of squirrel that brought in the material. Four Red Squirrel kits were produced in one nest and three Northern Flying Squirrel kits in another.

Twenty-one individual prey items, of six species, were identified at active nests. Sixteen of these were found when nest boxes were opened and five when males were trapped during prey delivery bouts. Nineteen mammals were found: Red-backed Vole (8), Meadow Vole (7), Deer Mouse (3) and shrew species (1). Two birds were found: Yellow Warbler and Eastern Phoebe.

Discussion

Cannings[3] reported that in southern British Columbia the average number of young produced per nesting attempt at nest boxes was 2.68 (n=22, SE=0.423) and the average number of young produced per successful nesting attempt was 3.47 (n=17, SE=0.365). These figures are low compared to what we found in central Alberta. The reason for the difference could be explained by our lower sample size, or by geographic or yearly variation. More data will have to be obtained before the cause for this difference can be addressed.

All published accounts from non-coastal areas report that small mammals are the primary prey of the Saw-whet.[3,5] Our findings concur with these reports. Owl prey is often identified by analyzing the contents of regurgitated pellets. Mammal species are easy to identify when owl pellets are analyzed because mammal dentition is well described and recognizable.[6]

Birds have been reported in Saw-whet diet studies, however, in many cases the species is not reported because it is often not possible to identify bird remains to species. In addition, Whalen and Watts reported that the remains of soft bodied invertebrates are unlikely to be found in pellets.[18] For this reason, pellet analysis may under-represent the importance of invertebrate biomass consumed by owls. Identifying prey items before they are digested would remove this bias. Our method of obtaining prey data allowed us to identify prey before they were consumed. Hence, we were able to identify two previously unreported prey species (Yellow Warbler and Eastern Phoebe).

Conclusion

We have been delighted that various people have expressed interest in building nest boxes so that they can assist our research efforts. For this reason, we have provided a detailed description of our nest box design below. We strongly encourage volunteers to undertake similar projects because study and sharing results will enable us to learn more about Saw-whets. This will be especially true if people from a wide geographic area get involved. If you want more information on this project, please contact us.

Nest boxes instructions

Materials

Use plywood (5/8" thick) for the walls, roof and floor. Four pieces of plywood 8" x16" are used for the box sides, back and front. One piece of plywood 9 1/2" x 11 1/2" is used for the roof of the box. The floor is made from a piece of plywood cut to 6 1/2" x 7 7/8". Twenty-four inch lengths of 3" x1" boards (we used fence boards) are attached to the center of the back of the box and are used to attach the box to the tree. Twenty-two 6 x 1 5/8 screws are used for assembly. One 6 x 1 5/8 screw is used to close the door. Two 8 x 2 1/2 screws are used for hinging the door. Six 8 x 3 screws are used to attach the nest box to the tree. In all cases, use external decking screws.

Pre-Assembly Steps

1. Cut a 3-inch round hole in the door piece for the entrance. The hole is centered 4" from the edge and 3 1/2" from the top.

2. Cut six grooves (1/8" deep) under the nest hole on the backside of the door using a circular saw (grooves cut to saw blade thickness). These grooves are intended to help the owls get in and out of the box.

3. Drill four 1/2" holes in the floor piece for drainage.

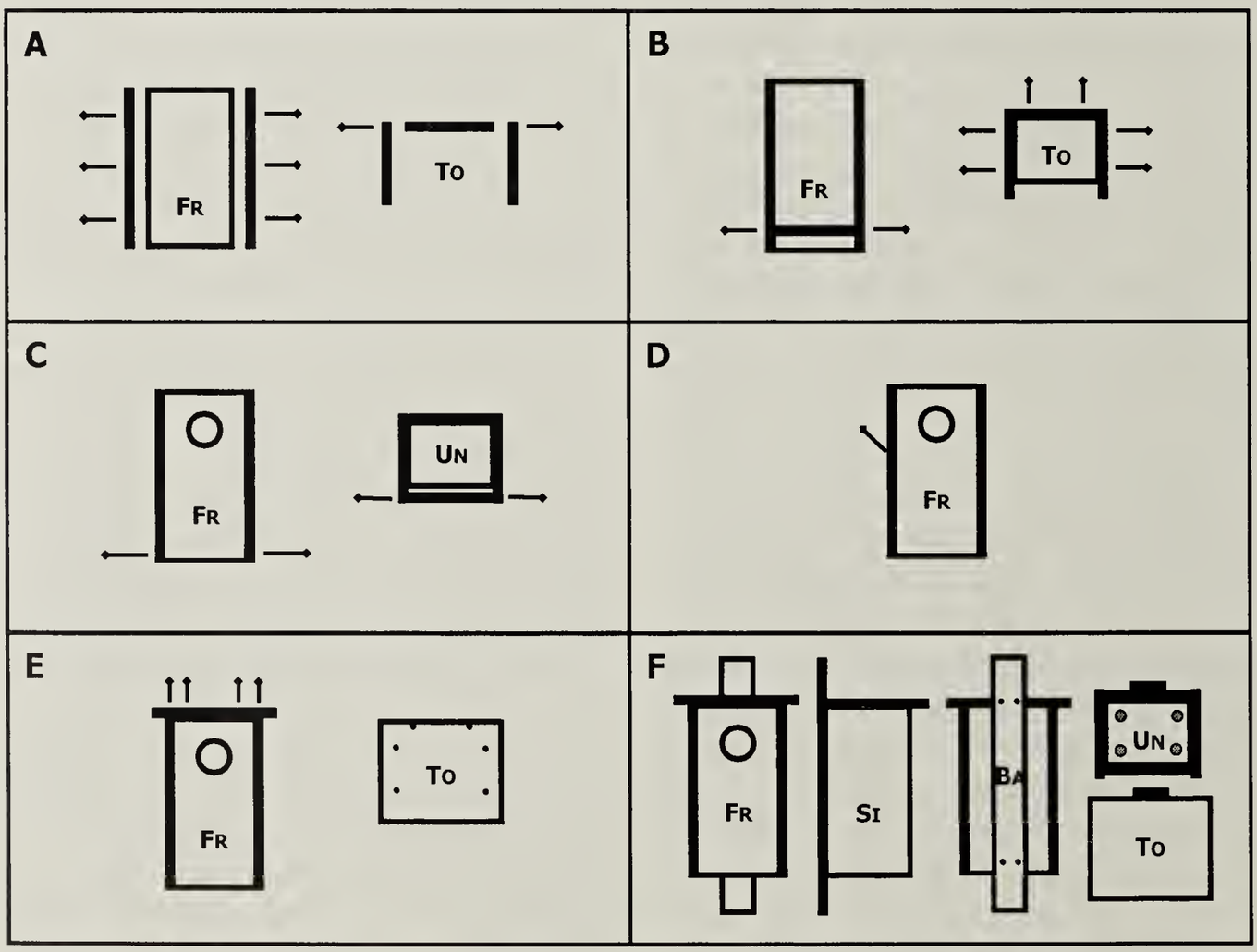


Figure 2: Steps for building Northern Saw-whet Owl nest boxes. Abbreviations indicate the vantage point of each diagram. FR, TO, UN, BA and SI denote: front, top, underneath, back and side respectively.

Assembly Steps (see Figure 2)

A. ATTACH SIDES TO BACK. Attach the two side pieces to the back of the box using three 6 x 1 5/8 screws per side.

B. ATTACH FLOOR TO SIDES. Attach the floor of the box so that the base of the floor is 1 1/2" from the bottom of the sides and back. The floor is secured with two 6 x 1 5/8 screws on each side and on the back of the box.

C. ATTACH DOOR. Attach the front of the box using one 8 x 2 1/2 screw on each side 1/2" from the bottom of each side. The box is designed to open and close using the two screws as a hinge. This saves money that would have been spent on traditional hinges and makes a door that is easy to replace as needed.

D. ATTACH LOCK FOR THE DOOR. Put a 6 x 1 5/8 screw in one side of the box so that the screw goes through the side and into the door at a 45-degree angle. This is intended to keep the door closed.

E. ATTACH ROOF. The roof of the box is attached using two 6 x 1 5/8 screws into the back piece and each side piece.

Figure 3. Northern Saw-whet Owl in nest box ***Lisa Priestley***

F. ATTACH TREE MOUNT. The strip of wood used to secure the nest box to the tree is attached with two 6 x 1 5/8 screws through the roof and two through the base.

Acknowledgments

We thank Ray Cromie for sharing his knowledge of Saw-whets and nest box monitoring. Mountain Equipment Co-op, Edmonton, donated equipment for volunteers. The following people kindly granted access to their land to put up nest boxes: Art and Leslie Ducherer, Lance Jones, Dick Schnider, Kathy Tomkins, Helen and Phil Trefry, Stewart Vanpetton, Paul Wentland and Betty Williams. Volunteer assistance from Juanita Mumby, Chad Shoaf, Julie Pierce, Jen Julien, Sandra Opdenkamp, Lucy Jarret, Tom and Jill Spence, Austin Spence-Green, Anne Hoff, Richard Krikun and Diane Carlson was greatly appreciated. Comments from an anonymous reviewer on an earlier version of this manuscript were appreciated.

1. Cannings, R.J. 1986. Infestations of *Carnus hemapterus nitzsch* (diptera: Carnidae) in Northern Saw-whet Owl nests. *Murrelet* 67:83-84.

2. Cannings, R.J. 1987. The breeding biology of Northern Saw-whet Owls in southern British Columbia. *In* R.W. Nero, R.J. Clark, R.J. Knapton and R.H. Hamre [eds.]. Biology and Conservation of Northern Forest Owls. Symposium proceedings Feb. 3-7, 1987; Winnipeg, Manitoba. Gen. Tech. Rep. RM-142, Fort Collins, Colo.

3. Cannings, R. 1993. Northern Saw-whet Owl (*Aegolius acadicus*), *in* The Birds of North America (A. Poole and F. Gill, eds.), no. 42. Acad. Nat. Sci., Philadelphia.

4. Granfield, W.M. 1937. Nesting of the saw-whet owl. *The Condor* 39(6):185-187.

5. Holt, D.W. and L.A. Leroux. 1996. Diets of Northern Pygmy Owls and Northern Saw-whet Owls in west-central Montana. *Wilson Bulletin* 108(1):123-128.

6. Marks, J.S. and J.H. Doremus. 1988. Breeding season diet of Northern Saw-whet Owls in southwestern Idaho. *Wilson Bulletin* 100(4):690-694.

7. Marks, J.S. and J.H. Doremus. 2000. Are Northern Saw-whet Owls nomadic? *Journal of Raptor Research* 34(4):299-304.

8. Marks, J.S., J.H. Doremus and R.J. Cannings. 1989. Polygyny in the Northern Saw-whet Owl. *Auk* 106(4):732-734.

9. Moser, B.W. 2002. Reproductive success of Northern Saw-whet Owls nesting in hybrid poplar plantations. *Northwest Science* 76(4): 353-355.

10. Priestley, C. 2003. Northern Saw-whet Owls at Beaverhill Lake. *The Willet* 16(1): 6-7.

11. Pyle, P. 1997. The Identification Guide to North American Birds: part 1. Slate Creek Press, Bolinas, CA. 732 pp.

12. Rains, C. 1997. Comparison of food habits of the northern saw-whet owl (*Aegolius acadicus*) and the western screech-owl (*Otus kennicottii*) in southwestern Idaho. pp. 339-346. *In* J.R. Duncan, D.H. Johnson and T.H. Nicholls [eds.]. Biology and Conservation of Owls of the Northern Hemisphere; second international symposium. February 5-9, 1997. Winnipeg, Manitoba, Canada. U.S. Department of Agriculture. Forest Service. North Central Forest Experiment Station, St. Paul, MN. GTR NC-190.

13. Santee, R. and W. Granfield. 1939. Behavior of the Saw-whet Owl in its nesting grounds. *The Condor* 41(1):3-9.

14. Sauer, J.R., J.E. Fallon and R. Johnson. 2003. Use of North American breeding bird survey data to estimate population change for bird conservation regions. *Journal of Wildlife Management* 67(2):372-389.

15. Saurola, P. 1987. Mate and nest-site fidelity in Ural and Tawny Owls. pp. 81-86. *In* R.W. Nero, R.J. Clark, R.J. Knapton and R.H. Hamre [eds.]. 1987. Biology and Conservation of Northern Forest Owls. Symposium proceedings. Feb. 3-7, 1987; Winnipeg, Manitoba. Gen. Tech. Rep. RM-142. Fort Collins, CO.

16. Takats, D.L., C.M. Francis, G.L. Holroyd, J.R. Duncan, K.M. Mazur, R.J. Cannings, W. Harris, and D. Holt. 2001. Guidelines to Nocturnal Owl Monitoring in North America. Beaverhill Bird Observatory and Bird Studies Canada, Edmonton, Alberta. 24 pp.

17. Thomas, L. and K. Martin. 1996. The importance of analysis method for breeding bird survey population trend estimates. *Conservation Biology* 10(2):479-490.

18. Whalen, D.M. and B.D. Watts. 2000. Diet of autumn migrating Northern Saw-whet Owls on the Eastern Shore of Virginia. *Journal of Raptor Research* 34(1):42-44

NOVEL FORAGING BEHAVIOURS OF BLACK-BILLED MAGPIES

USNE J. BUTT, E-mail: <usne.butt@usask.ca>, JULIO BLAS, E-mail: <julio@ebd.csic.es>, MICHAEL S. POLLOCK, E-mail: <Mike.Pollock@sasktel.net>, Department of Biology, University of Saskatchewan, Saskatoon, SK S7N 5E2

Corvids, including crows, jays, and magpies, exhibit a variety of foraging behaviours including fecal sac ingestion,[8] using objects to displace gulls from nests,[9] and drowning prey.[1] Black-billed magpies have been observed removing ectoparasites from deer[3] and wild boar,[7] preying on small mammals,[2,10,4] and feeding in fruit trees and at suet feeders.[10] Here we report some previously undocumented foraging behaviours by magpies that were observed at the campus of the University of Saskatchewan, in Saskatoon, between 1999 and 2003.

Insects on Tree Bands

On campus, as well as in the older neighbourhoods in Saskatoon, sticky bands placed on American Elms (*Ulmus americana*) are used to assist in the prevention of canker worm infestations. These bands consist of fiberglass insulation wrapped around the trunk of the tree, bound tightly with tape or plastic and covered with a layer of Tanglefoot™, a 25% natural gum resin-based substance ideal for capturing the canker worm moths. Tanglefoot™ ensnares indiscriminately and tree bands become covered with an array of insects and arachnids. Several times during the winter of 1999-2000 in the University of Saskatchewan "Bowl," (an open landscaped area surrounded by buildings), Usne J. Butt observed magpies, perched above or below tree bands on elm trees, taking insects directly from the bands with their beaks. Obtaining food in this manner is not without potentially negative consequences; small songbirds have been admitted to the University of Saskatchewan Small Animal Clinic after adhering to the Tanglefoot™ (C. Wheler, pers. comm.) and it is possible that inadvertent consumption of resin has toxicological effects.

Insects on Cars

In November 2000, Usne J. Butt observed two magpies eating insects off the front bumpers and undercarriage of vehicles parked on campus.

Predation on Waxwings

In February 2003, Julio Blas observed a magpie predation attempt on a Bohemian Waxwing. While the observer was taking pictures of a flock of waxwings feeding on berries in the "Bowl," a magpie suddenly flew into the shrub and forced one of the birds to the ground. The magpie then stood on top of the waxwing and aggressively pecked its body. The magpie retreated at the observer's approach and did not kill the waxwing. On several occasions during that fall and winter, magpies were seen carrying remains of waxwings and caching them at the base of tree trunks. Although they were presumed to have collected waxwings killed by colliding with windows, the latter observation suggests that active predation of healthy birds also occurs.

Piscivory

There have been other observations of magpies scavenging carrion and actively preying on small mammals and birds.[10] To our knowledge, however, there are no published observations on magpies eating live fish. In October, 2002, Michael Pollock was running experiments in 18,000 litre outdoor pools behind the W.P. Thompson

Building. The pools, which had styrofoam blocks (60 cm x 60 cm x 3 cm) floating on the surface, contained Fathead minnows (*Pimephales promelas*) and Northern Pike (*Esox lucius*). Over 14 days, one pike and 350 Fathead Minnows disappeared from the pools. Despite the fact that the fish were apparently being consumed, the growth rates of the predatory pike and numbers of missing minnows failed to correlate, suggesting that the disappearance of the fish could not be solely attributable to predation by pike. Fortunately, Julio Blas had previously observed a magpie standing on the styrofoam blocks and catching fish over several days. The magpie captured minnows as they approached the surface and then cached them in the leaf litter and in trees around the pool.

Over the last 35 years, the Black-billed Magpie has expanded its range across western Canada[5,10] and is now a common resident in Saskatoon. In fact, over 50 active nests were identified on the University of Saskatchewan campus during the summer of 2000 (G. Bortolotti unpub. data). Part of the magpie's success may be attributable to its ability to fledge chicks successfully in urban habitats.[6] Furthermore, learning to exploit novel food sources such as those described here may increase the likelihood of survival during Saskatchewan winters.

Acknowledgements

Special thanks to G. R. Bortolotti and D. O. Joly for remarks on an earlier draft of this manuscript.

1. BLACKBURN, C.F. 1968. Yellow-billed magpie drowns its prey. *The Condor* 80:349.

2. BOXALL, P.C. 1982. Further observation of predation by Black-billed Magpies on small mammals. *Journal of Field Ornithology* 53:172-173.

3. GENOV, P.V., GIGANTESCO, P., and MASSEI, G. 1998. Interactions between Black-Billed Magpie and Fallow Deer. *The Condor* 100:177-179.

4. GOULDEN, L.L. 1975. Magpie kills a ground squirrel. *The Auk* 92:606.

5. HOUSTON, C.S. 1977. Changing patterns of Corvidae on the prairies. *Blue Jay* 35:149-156.

6. KNIGHT, R.L. and FITZNER, R.E. 1985. Human disturbance and nest site placement in Black-billed Magpies. *Journal of Field Ornithology* 56:153-157.

7. MASSEI, G. and GENOV, P. 1995. Observations of Black-Billed Magpie (*Pica pica*) and Carrion Crow (*Corvus corone cornix*) Grooming Wild Boar (*Sus scrofa*). *Journal of Zoology* 236:338-341.

8. MCGOWAN, K.J. 1995. A test of whether economy or nutrition determines fecal sac ingestion in nesting corvids. *The Condor* 97:50-56.

9. MONTEVECCHI, W.A. 1978. Corvids using objects to displace gulls form nests. T*he Condor* 80:349.

10. TROST, C.H. 1999. Black-billed Magpie (*Pica pica*). In: The Birds of North America, No.389 (A. Poole and F. Gill, eds.) The Birds of North America, Inc. Philadelphia, PA.

"The sandflies were most troublesome all day, and towards evening the mosquitoes came out in force. The latter I divide into three classes: the common brown, the large soft drab, and the fierce little black—Quirk, Gammon, and Snap! I named them thus after the well-known firm of lawyers in *Ten Thousand a Year*. The Quirks were pertinaciously bloodsucking, in a humdrum, respectable manner; the Gammons alighted like thistle-down, and drank your blood with tender slyness; the Snaps rushed in with sudden fury, and nipped more than they sucked, though careful not to go empty away."

Southesk, The Earl of (James Carnegie). 1875. *Saskatchewan and The Rocky Mountains.* Edmonston and Douglas, Edinburgh. p. 67-68.

THREE BONAPARTE'S GULL NESTS AT SPRUCE LAKE, SK

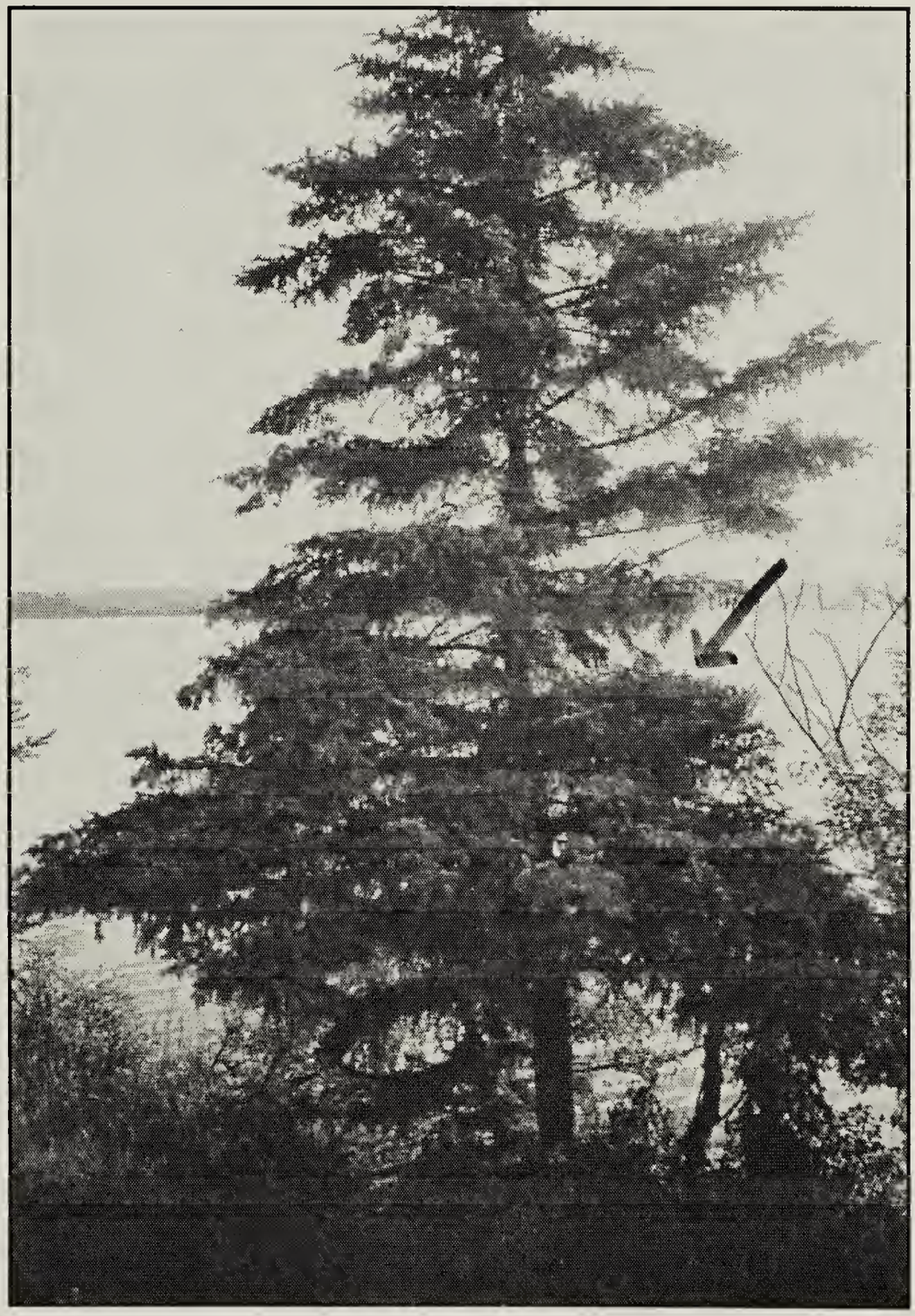
MARY I. HOUSTON and C. STUART HOUSTON, 863 University Drive, Saskatoon, SK S7N 0J8

Our first sighting of a Bonaparte's Gull nest occurred on June 19, 2004, during the bus tour to Spruce Lake during Nature Saskatchewan's Spring Meet. Our entire party observed three pairs nesting, each in a small, solitary spruce, beside the lakeside trail on the north shore of Spruce Lake, 14 km south of St. Walburg. Stuart and I stopped again on June 20 and paid a third visit on July 18.

The first nest, in a spruce right on the bank of the lake, was 2 m above the lake level. An adult sat tight on June 19, but rose up to display at least two downy young on June 20. On July 18, one adult sat at the top of the spruce, then both adults dove at us.

The second nest, also in a spruce right on the bank, was about 60 m along the shore from the first nest (by GPS calculations) and 2.7 m above the lake level. The adult sat tight on June 19, but the following day rose up sufficiently to reveal three young. Both adults dove at us when we returned on July 18.

The third nest was in a spruce 1 or 2 m from the lake edge, and another 225 m along the shore from the second nest. It was 3.5 m



Location of Bonaparte's Gull nest # 1 at Spruce Lake, on 19 June 2004 ***Mary Houston***

above ground, too high to see into without disturbing the adult. On July 18, the nest had apparently fallen, but two adults dive-bombed us.

No young were visible on July 18, but the behaviour of the all three pairs of adults suggested persistent territorial defense or possibly one or more flightless young hiding somewhere in the vicinity. The commonest clutch size is three eggs. Young are said to remain in the nest for two to seven days after hatching, but no data are available concerning the age at first flight.[1]

We thought it remarkable that the first and second nests were in the only two suitable spruce on that part of the lakeshore, and closer together than typical Bonaparte's Gull nests. Near Churchill, Manitoba, "individual territories are large and inter-nest distances are usually >500 m."[2]

Bonaparte's Gull is the only gull "that regularly, indeed almost always, nests in trees." [1] As with most rules, there are exceptions; the best-documented marsh nesting of this species is for "Lamotte's Swamp" near Jackfish Lake, Saskatchewan, in 1931-1935 and again in 1955 and 1956.[3]

1. BURGER, J., and M. GOCHFELD. 2002. Bonaparte's Gull (*Larus philadelphia*). *In* The Birds of North America, no. 634 (A. Poole and F. Gill, eds.). The Birds of North America, Philadelphia, PA.

2. JEHL, J.R., Jr. 2004. *Birdlife of the Churchill Region: Status, History, Biology.* Trafford Publishing, Victoria, BC.

3. SYMONS, R.D. 1968. Atypical nesting of Bonaparte's Gull in Saskatchewan. *Blue Jay* 26:70-74.

SURPRISE EFFECT

Warm July afternoon
walking back to the car
while the dog explores afar
casting my eyes downward
blinking in the bright light
suddenly a swift shadow
flits across the path
look up in surprise
as a large dragonfly skims past
on gauzy transparent wings
glad to be reminded that
even such a fragile form
casts so solid a shadow.

- Bob Nero

PLANTS

SMOOTH GOOSEFOOT REDISCOVERED IN MANITOBA

DIANA BIZECKI ROBSON, The Manitoba Museum, 190 Rupert Avenue, Winnipeg, MB R3B 0N2, E-mail: <drobson@manitobamuseum.ca>, JASON GREENALL, CARY HAMEL and CATHY FOSTER, Manitoba Conservation, Wildlife and Ecosystem Protection Branch, 200 Saulteaux Cres., Winnipeg, MB R3J 3W3. E-mail: <jgreenall@gov.mb.ca>

Introduction

Smooth Goosefoot (*Chenopodium subglabrum* (S. Wats.) A. Nels.), is a nationally rare annual plant that typically grows in active to semi-stabilized sand dunes and blowouts, and along eroding, sandy river banks and coulees.[2, 5, 8, 10] B. Boivin and E. Laisley collected one specimen of Smooth Goosefoot in the Oak Lake Sand Hills of Manitoba in 1959. Despite periodic searches over several decades by botanists at the Manitoba Conservation Data Centre (MCDC), The Manitoba Museum and University of Manitoba, no other plants have been found. As 45 years had passed since this species was first found, the MCDC was considering changing the status of this plant from S1 (very rare throughout its range or in the province) to SH (historically known) or SX (believed to be extirpated provincially).[6] The rediscovery of Smooth Goosefoot in Manitoba in the summer of 2004 ensures that it will retain its S1 status and possibly be legally protected under Manitoba's *Endangered Species Act, 1990*.

Manitoba has six major areas of sand hills in the southwestern corner of the province: Brandon, Lauder, Oak Lake, Routledge, Souris and St. Lazare.[3] The Brandon Sand Hills (also known as Assiniboine Delta and Carberry Sand Hills) are the largest, covering 964 km^2; part of this area lies within the borders of Spruce Woods Provincial Park. The Souris, Oak Lake, Lauder and Routledge Sand Hills west of Brandon, are adjacent to each other and together cover about 198 km^2. The St. Lazare Sand Hills, covering only 62 km^2, occur along the Assiniboine River near the Saskatchewan border.

Active sand dunes are dynamic habitats so their exact location changes over time. Elizabeth Punter (pers. comm.) noted that open sand dunes are shown about 6.4 km north of Oak Lake on the 1959 edition of the 62F/15 1:50 000 provincial topographic map. However, her impression of that area now is that it is "treed or scrub, grazed, or had houses built on it, and possibly may have been disturbed (for sand and gravel) when the highway was rebuilt." If this was the area where Smooth Goosefoot was first found, it is likely no longer suitable habitat, as this species requires some active sand. Only the Brandon Sand Hills contain actively moving sand dunes; the other sand hills in Manitoba contain some bare sand in the form of sand plains, semi-stabilized dune ridges and/or exposed blowouts. [11]

Unlike the sand hills in Alberta and Saskatchewan, Manitoba's sand hills contain significant cover of woody species such as alder (*Alnus* spp.), American Elm (*Ulmus americana*), Balsam Poplar (*Populus balsamifera*), birch (*Betula* spp.), Bur Oak (*Quercus macrocarpa*), Chokecherry (*Prunus virginiana*) and Manitoba Maple (*Acer negundo*). This is largely because Manitoba's sand hills occur in the moister and more fertile Aspen Parkland ecoregion

Figure 1. Smooth Goosefoot (centre) growing in the Routledge Sand Hills, August 23, 2004 ***Diana Robson***

rather than the Moist Mixed Grassland and Mixed Grassland ecoregions where the major Alberta and Saskatchewan sand hills occur. [1]

Field Observations in 2004

While conducting Smooth Goosefoot surveys we found this species in the Routledge Sand Hills of Manitoba on August 23, 2004 (Figure 1). Rather than visiting the Oak Lake Sand Hills where the first population was found, we decided to visit a nearby dune ridge in the Routledge Sand Hills that contained a population of the nationally rare Western Spiderwort (*Tradescantia occidentalis*). The bare sand at this site was thought to be appropriate habitat for Smooth Goosefoot.

At this site, Smooth Goosefoot plants were growing on an eroding dune ridge that had partly stabilized (Figure 2). Two plants were growing about 2 m apart on a west-facing slope, and a second group of 17 plants was spread over a 36 m^2 area on a south-facing slope approximately 20 m away. All plants observed were in flower or in seed. The areas where the Smooth Goosefoot was growing had about 40% vegetation cover. Associated species included Narrowleaf Goosefoot (*Chenopodium pratericola*), Nuttall's Sunflower (*Helianthus nuttallii*), Hairy Golden Aster (*Heterotheca villosa*), Creeping Juniper (*Juniperus horizontalis*) and wild roses (*Rosa* spp.). Six provincially rare plants also occurred in the same area: Sand Bluestem (*Andropogon hallii*), Sand Nut-grass (*Cyperus schweinitzii*), Ball Cactus (*Escobaria vivipara*), Annual Skeletonweed (*Lygodesmia rostrata*), Louisiana Broom-rape (*Orobanche ludoviciana*) and Indian Rice Grass (*Achnatherum hymenoides*).[6] The Louisiana Broom-rape had never been recorded on this dune ridge before. Voucher specimens and digital photographs of Smooth Goosefoot and Louisiana Broom-rape were taken and are filed at The Manitoba Museum.

Figure 2. The partly stabilized dune ridge habitat of Smooth Goosefoot in the Routledge Sand Hills, August 23, 2004 ***Diana Robson***

On August 25, 2004 Smooth Goosefoot was searched for in the Brandon Sand Hills along Spirit Sands Trail in Spruce Woods Provincial Park but only Narrowleaf Goosefoot was observed. Nonetheless, the species may still be present, since this area is large and not all of it was searched. None of the other sand hills in Manitoba was searched.

Discussion

There are several possible reasons why Smooth Goosefoot was not found growing at this site in previous years. One is that botanists visiting the sand hills did not see this inconspicuous plant. Smooth Goosefoot is often less than 10 cm tall and, if hidden amongst taller vegetation, would not be detected easily, especially if the population is small. Furthermore, Smooth Goosefoot closely resembles Narrowleaf Goosefoot, which occurs in the same habitat (Table 1).[7] Since detecting most of the distinguishing characters requires close examination, anyone not inspecting each *Chenopodium* plant in the area could overlook Smooth Goosefoot.

The second possible reason for the lack of detection in the past relates to the annual nature of Smooth Goosefoot. Annual plants in dry environments, like sand hills, go dormant and germinate, grow and produce seeds rapidly when moisture is temporarily available.[4] Lamont and Gerry asserted that dry weather could limit the persistence or spread of Smooth Goosefoot.[5] The dramatic increase in the number of individuals observed by the first author at most sites in Saskatchewan in 2004, coupled with the observation that the summer of 2004 was unusually wet and cool, suggests that maximum seed germination occurs under moist conditions. This means that Smooth Goosefoot seeds are likely capable of remaining dormant for many years, possibly even decades, only germinating under appropriate conditions. If the sand hills were visited in dry years, or more specifically in

Table 1. Key taxonomic differences between Smooth and Narrowleaf Goosefoot. [7]

Character	Smooth Goosefoot	Narrowleaf Goosefoot
No. leaf veins	One	Three
Seed size	~1.5 mm	0.9-1.2 mm
Leaf vestiture	Glabrous to very sparsely farinose	Moderately to densely farinose
Leaf shape	Linear	Linear to lanceolate or oblong-elliptic
Leaf margin	Entire	Entire or toothed

years when rainfall did not occur in late summer, Smooth Goosefoot may have been present only in the seed bank.

The Manitoba population of Smooth Goosefoot is disjunct from the species' main range. The closest known population in Canada is about 550 km to the northwest in the Pelican Lake Sand Hills near Caron, Saskatchewan, and the closest known population in the United States is about 350 km to the southwest in the Little Missouri National Grassland of North Dakota.[9] The Manitoba population may be unique genetically due to its isolation. Additional field work in other sand hills of Manitoba is required to determine the health and true extent of this rare, outlying population.

Acknowledgements

Funding for this research was provided by Environment Canada in connection with field work for a COSEWIC status report, and Manitoba Conservation. Thanks to Cindi Steffan for reviewing this paper.

1. ACTON, D.F., G.A. PADBURY, and C.T. STUSHNOFF. 1998. The Ecoregions of Saskatchewan. Canadian Plains Research Center, Univ. Regina, Regina.

2. ARGUS, G.W., and K.M. PRYER. 1990. Rare Vascular Plants in Canada. Canadian Museum of Nature, Ottawa.

3. DAVID, P.P. 1977. Sand dune occurrences of Canada. Parks Canada, Department of Indian and Northern Affairs, Ottawa.

4. GRIME, J.P. 1979. Plant Strategies and Vegetation Processes. John Wiley & Sons, Bath, U.K.

5. LAMONT, S., and A. GERRY. 1998. Species status report *Chenopodium subglabrum* (S. Wats.) A. Nels. Saskatchewan Conservation Data Centre, Regina.

6. MANITOBA CONSERVATION DATA CENTRE. 2004. Vascular plant list. Web site: http://web2.gov.mb.ca/conservation/cdc/. (Accessed November 2004).

7. MOSS, E. 1983. Flora of Alberta. University of Toronto Press, Toronto

8. ROBSON, D.B. 1997. Ecology of Rare Vascular Plants in Southwestern Saskatchewan. M.Sc. dissertation, Univ. Saskatchewan, Saskatoon.

9. SCHMOLLER, D. 2002. *Chenopodium subglabrum* surveys 2002 field season. Yellowfield Biological Surveys, North Dakota.

10. SMITH, B., and C. BRADLEY. 1990. Status report on the Smooth Goosefoot *Chenopodium subglabrum* (S. Wats.) A. Nels. Committee on the Status of Endangered Wildlife in Canada, Ottawa.

11. WOLFE, S.A. 2001. Eolian deposits in the Prairie Provinces of Canada. Natural Resources Canada, Ottawa.

"In the nineteenth century orchids were collected by the ton. Once, four thousand trees were cut down for the orchids growing on them. One collector alone was said to have sent one hundred thousand orchids to England, many of which died.
Wilhelm Micholitz sent home an orchid growing in a human skull, which was auctioned for a hugh sum complete with container."

Diana Wells, *100 Flowers and How They Got Their Names*, p. 157

HABITAT PREFERENCES OF ARCTIC SHREW IN CENTRAL AND SOUTHERN ALBERTA

JIM R. SALT, E-mail: jrsalt@telus.net

Arctic Shrew ***Jim Salt***

During the 1970s I conducted field studies of small mammals at many sites in western, central and southern Alberta, using a variety of trap methods. Sherman and pitfall live traps, Museum Special traps and several alternative field methods were tested repeatedly from late 1972 until 1980.

The most intensive and prolonged period of field work was conducted in the Pigeon Lake area, from Thorsby vicinity south to the northwest end of Pigeon Lake, westward some 10 km and south to Battle Lake and Battle Creek. This region contained examples of isolated muskegs and bogs, a variety of marshes and seasonal wetlands, deciduous and mixed woods, grazed pastures, meadows and grassy clearings. There was also one wooded site burned in May 1966, consisting of poplar (predominantly aspen) and a few lodgepole pine, growing in as dense aspen poplar. The Arctic Shrew, *Sorex arcticus*, was one of the three most common species recorded in central Alberta during these surveys. The present note concerns the habitat preferences of this shrew as indicated by trap captures and other detection methods, supplemented by information from previous field-workers in the areas of my studies.

According to the great majority of sources, the Arctic Shrew is found primarily in wet environments, marshes, muskegs and poorly-drained lowlands.[1-4] Wrigley et al (1979) is one of the few accounts to note a wider range of possible habitats for the species.[5] In fact, the results of the central

Alberta field work in the 1970s indicated that this species occurred in greatest concentrations in a variety of dry or well-drained habitats, such as enclosed meadow, grassy woods-edges or clearings, and the higher ground associated with coniferous woods and lakes or streams. Soper (pers. comm.) had sampled with snap traps in this same area in the years 1936-37, and had found no sign of Arctic Shrew except for a single specimen at the end of Battle Lake in 1937. Lister had collected another individual at the north end of Pigeon Lake in 1952 (University of Alberta Zoology Museum specimen).

The table below contains numbers of *Sorex arcticus* recorded in four types of habitat by all capture methods. The data, based on a total of 154 individuals, represent records from the Pigeon Lake and Battle Lake areas, the Edmonton vicinity (Devon, Winterburn, Cawes Lake, Acheson, etc.), Dried Meat Lake, Cooking Lake vicinity, Edson and Blue Lake regions, Rocky Mountain House, Jackfish Lake and Nordegg. The four habitat types were: 1) dry, long grass in enclosed meadows, grassy margins of woods and dry stream courses; 2) the interiors of mature poplar and mixed woods, particularly those with some deadfall, and small clearings; 3) seasonally wet areas, willow margins near sloughs and ponds, boulder banks of lakes or rivers, stream or pond banks well above water-line; and 4) permanently damp lowlands such as bog, muskeg or marsh.

A total of 160 Arctic Shrew records was examined. When grouped simply according to "dry, well-drained" or "wet, poorly drained" environments, at least 121 (more than 76%) of Arctic Shrew captures were made in the dry locations; about 33 (20% of captures) were taken in permanently damp to wet areas, while no ecological data were available for the remaining 6 records.

Of the other species found during these surveys at the same trap stations with Arctic Shrew, the Red-backed Vole (*Clethrionomys gapperi*) was the most numerous, followed by Masked Shrew (*Sorex cinereus*). Less numerous and more ecologically restricted species were Meadow Vole (*Microtus pennsylvanicus*), Dusky Shrew (*Sorex monticolus*), Deer Mouse (*Peromyscus maniculatus*), Water Shrew (*Sorex palustris*) and Meadow Jumping Mouse (*Zapus hudsonius*). The proportions and numbers of each species varied with specific habitat.

1 - Meadow/Edges	2 - Woods	3 - Seasonally wet	4 - Bog/muskeg
98	24	19	13

1. BUCKNER, C.H. 1966. Populations and ecological relationships of shrews in tamarack bogs of southeastern Manitoba. *Journal of Mammology.* 47(2): 181.

2. CLOUGH, G.C. 1963. Biology of the arctic shrew, *Sorex arcticus. American Midland Naturalist* 69: 69.

3. SOPER, J.D. 1964. The Mammals of Alberta. Hamly Press, Edmonton; 402p. + Index.

4. VAN ZYLL DE JONG, C.G. 1983. Handbook of Canadian Mammals. 1. Marsupials and insectivores. Nat. Mus. Nat. Sci., Nat. Mus. of Canada.

5. WRIGLEY, R.E., J.E. DUBOIS & H.W.R. COPELAND. 1979. Habitat, abundance, and distribution of six species of shrews in Manitoba. *Journal of Mammology* 60: 505-520.

A LIST OF THE ODONATA OF ATHABASCA SAND DUNES PROVINCIAL WILDERNESS PARK, SK

GORDON E. HUTCHINGS, 971 Arundel Drive, Victoria, BC V9A 2C4
E-mail: odonatas@uvic.ca

Introduction

Athabasca Sand Dunes Provincial Wilderness Park (ASDPWP) is situated on the south shore of Lake Athabasca in Saskatchewan. This 1,925 square kilometre park, created in 1986, features open sand sheets, active dunes, extensive pine/lichen forests and a wide variety of interspersed wetlands featuring large rivers, lakes and spruce bogs.[2, 6] Its variety of habitats situated in a remote, northern latitude are home to unique organisms found nowhere else, including at least nine endemic plants and one insect (*Cicindela hirticollis athabascensis*, the Athabasca race of the Beach Tiger Beetle[1]). Because so little is known of the invertebrate fauna,[6] every collecting trip has produced new range extensions for many species and there is much yet to be discovered.

This article reports the results on the Odonata (Dragonfly and Damselfly) portion of a 14-day survey which took place from July 2 to July 15, 2004 at ASDPWP. Participants were Ron Hooper and myself. We collected insects from a variety of orders during this period but mainly concentrated on groups associated with aquatic habitats. The Odonata were my main focus, due to my familiarity with this order of insects in Saskatchewan. This preliminary list of species represents only the second survey for odonates in ASDPWP; the previous survey was done in 2002.[4]

Methods and materials

The survey was carried out on foot from a central base-camp along Thomson Bay between William Point and Beaver Point on the south shore of Lake Athabasca. All study sites were situated between the William River to the west and Cantara Lake/Beaver Point to the east. They included a river, large and small lakes, pine forest, dune slacks (partially vegetated sand dunes), ponds, a large fen/bog complex as well as open sand dunes. Because travel was done completely on foot, specific areas deemed suitable for odonates were chosen within a 20 kilometre radius from base camp. Air photos and topographical maps were used in choosing which sites to visit in the limited time available. The air photos provided for the expedition were especially valuable for this. Information on the sites is given in Table 1.

Aerial nets were used to collect adults patrolling territory and mating at the perimeter of wetlands, and feeding in open, terrestrial habitats ranging from sand dunes to pine forests. Adults were collected during the warmer hours of the day when they are active which was between 9:00 a.m. and 7:00 p.m. approximately. Some dusk-feeding adults were collected up until 9:30 p.m.. Larvae were collected with aquatic insect nets.

Voucher specimens were collected for all species encountered at each site. Mating

Table 1. Specific odonata collecting sites in 2004.

code*	lat./long.	elevation (m)	Site description	Date
ASDG(01)	N59E05'00.53" W109E07'18.10"	215.2	beach edge basecamp at Thomson Bay	VII.02 & 06
ASDG(02)	N59E04'56.15" W109E07'16.61"	219.3	pine forest behind base camp	VII.02
ASDG(03)	N59E04'54.41" W109E06'25.82"	218.3	pine forest behind base camp and to the east	VII.03
ASDG(04)	N59E05'24.94" W109E03'01.04"	224.8	Flycatcher Pond in pine forest at Thomson Bay	VII.03
ASDG(05)	N59E07'09.81" W108E55'25.07"	223.2	fen complex east of Cantara Lake	VII.03
ASDG(06)	N59E04'43.00" W109E07'16.48"	239.3	edge of pine forest and sand dune behind camp	VII.04
ASDG(07)	N59E02'56.19" W109E05'07.98"	265.2	small pond in dune slacks ~4 km south of camp	VII.05
ASDG(08)	N59E01'00.21" W109E01'54.62"	289.7	Robin Lk. ~9 km south of base camp	VII.05
ASDG(09)	N59E08'49.17" W109E16'23.28"	213.1	pond & fen at north end of William Point	VII.07
ASDG(10)	N59E05'19.84" W109E11'52.28"	259.9	thick pine forest south of tip of William Point	VII.07
ASDG(11)	N59E03'57.65" W109E12'31.60"	224.8	bog adjacent to William River	VII.07
ASDG(12)	N59E05'00.92" W109E06'30.15"	215.9	small string bog along beach east of base camp	VII.09
ASDG(13)	N59E06'04.69" W108E56'43.08"	219.1	small ponds southwest of Cantara Lake	VII.10
ASDG(14)	N59E06'21.12" W108E55'43.26"	209.2	bogs south of Cantara Lake	VII.10
ASDG(16)	N59E04'44.53" W109E09'30.47"	228.0	pine forest between dunes in Thomson Bay	VII.12
ASDG(17)	N59E02'39.28" W109E11'49.96"	220.0	William River and adjacent pine forest	VII.12
(CANTAR)	N59E07'34.49" W108E55'49.70"	222.9	Cantara Lake	VII.02 & 10

*** brackets ( ) designate referenced abbreviated code**

pairs, and cannibalistic and other pairs in predator/prey interactions were kept together. Identification of specimens was carried out in the field using hand lenses and the collector's personal expertise. Further applicable and relevant literature was consulted once the collector returned home and comparisons were performed with personal holdings of other Odonata specimens.[10, 11, 12] The specimens were immediately prepared and preserved using the latest known methods, and later deposited at the Royal Saskatchewan Museum in Regina. Confirmation was performed by a second odonatologist at the Royal British Columbia Museum before sending on to the musuem in Regina.

Results and discussion

In total, 31 species were recorded for 2004, and in combination with the 22 species from the previous survey in 2002, this produced a combined list of 34 different species now recorded for the area.[3, 4, 5]

Odonata suborders, families and species	collecting sites
suborder ZYGOPTERA - Damselflies	
Family CALOPTERYGIDAE – Broad-wing Damsels	
Calopteryx aequabilis – Ebony Jewelwing	11, 17
Family LESTIDAE – Spreadwings	
Lestes congener - Spotted Spreadwing	9
Lestes disjunctus - Common Spreadwing	4, 5, 7, 8, 9, 11 12, 13, 14, CANTAR
Lestes dryas - Emerald Spreadwing	10
Family COENAGRIONIDAE - Pond Damsels	
Coenagrion interrogatum - Subarctic Bluet	3, 4, 5, 7, 8, 10, 13, 14
Coenagrion resolutum - Taiga Bluet	4, 5, 7, 8, 10, 13, 14
Enallagma boreale - Boreal Bluet	4, 8, 10, 13
Enallagma cyathigerum - Northern Bluet	8, CANTAR
Enallagma ebrium - Marsh Bluet	13
Nehalennia irene - Sedge Sprite	4, 5, 7, 13, 14
suborder ANISOPTERA - Dragonflies	
Family AESHNIDAE - Darners	
Aeshna canadensis - Canada Darner	17
Aeshna eremita - Lake Darner	every site
Aeshna interrupta - Variable Darner	1, 13
Aeshna juncea - Sedge Darner	1, 10, 11, 16, 17
Aeshna sitchensis - Zigzag Darner	1, 2, 8, 9, 10, 13
Aeshna subarctica - Subarctic Darner	5, 17
Aeshna tuberculifera - Black-tipped Darner	5, 14
Aeshna umbrosa - Shadow Darner	1, 17, CANTAR
Family GOMPHIDAE - Clubtails	
Ophiogomphus colubrinus - Boreal Snaketail	2, 11, 17
Family CORDULIIDAE – Emeralds	
Cordulia shurtleffi - American Emerald	2, 4, 9, 10, 11, 13, 14
Somatochlora albicincta - Ringed Emerald	14, 16
Somatochlora cingulata - Lake Emerald	1, 8, 14, 16, CANTAR
Somatochlora forcipata - Forcipate Emerald	1
Somatochlora franklini - Delicate Emerald	1, 2, 6, 8, 10, 11, 12, 13, 14, 17, CANTARA
Somatochlora kennedyi - Kennedy's Emerald	1
Somatochlora minor - Ocellated Emerald	1, 8, 11
Somatochlora walshii - Brush-tipped Emerald	1, 2, 6, 12, 14, 16, 17
Somatochlora whitehouse - Whitehouse's Emerald	1, 8, 10, 11, 12, 13, 14, CANTARA
Family LIBELLULIDAE - Skimmers	
Leucorrhinia borealis - Boreal Whiteface	1
Leucorrhinia glacialis - Crimson-ringed Whiteface	4, 5, 7, 13
Leucorrhinia hudsonica - Hudsonian Whiteface	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13
Leucorrhinia patricia - Canada Whiteface	5, CANTAR
Leucorrhinia proxima - Red-waisted Whiteface	4, 8, 10,
Libellula quadrimaculata – Four-spotted Skimmer	1, 4, 7, 9, 10, 11

Table 2. Odonata species and associated collecting sites. Common names are from the North American Odonata checklist.[7]

The list of species in Table 2 presents the combined species list of dragonflies thus far collected from ASDPWP from the 2002 and 2004 field trips. Listings have been broken down into taxonomic levels from sub-order, down to individual species and then treated separately.

The 2004 survey extended the ranges of several species in the province and contributed to the current knowledge available for the Odonata in Saskatchewan.[8, 9] The information in this report is based on observations of approximately 4000 individual odonates either collected and examined in-hand, or verified at close proximity on the wing or perched; 332 specimens representing 6 families were retained for the Royal Saskatchewan Museum. In most cases, only a few specimens of each species were collected from a given site and the number does not represent the abundance of that particular species documented there.

This survey provides a baseline for future searches for additional new and interesting records. For a more complete picture of local diversity, further sampling over the entire spring and summer months will most likely add new species. The optimal time of year for adult Odonata sampling in the northwestern part of the province seems to be from mid-July to mid-August. Another way of sampling in the future would be to do more aquatic netting to obtain Odonata in the larval stage, and visiting more sites in subsequent years. ASDPWP sites with the characteristics and traits known to support high species diversity of Odonata in adjacent areas in Canada, instead proved to have large numbers of individuals of low to medium diversity. Species to look for in ASDPWP are: *Aeshna septentrionalis* (Azure Darner), *Somatochlora brevicincta* (Quebec Emerald), *S. hudsonica* (Hudsonian Emerald), *S. septentrionalis* (Muskeg Emerald), and *Sympetrum costiferum* (Saffron-winged Meadowhawk).

Acknowledgements

Critical funding was graciously provided by the Saskatchewan Heritage Foundation and Royal Saskatchewan Museum. Peter Jonker, of the University of Saskatchewan, was instrumental in assisting with the funding agencies and also took care of the logistics for transport to the park from Fond-du-lac. Peter patiently answered many questions and provided critical survival, safety and specialised camping equipment. Chris Goode and George Bihun provided the use of a satellite phone, as well as a permit to collect insects in the park. It was Keith Roney from the RSM who first mentioned this particular area as he had previously been there with an expedition in 1981. Keith also provided an additional malaise trap and other field collecting equipment as well as preserving fluids and storage boxes for the specimens. And finally I would like to thank Ron Hooper for assistance with the logistics for this trip as well as his companionship at base camp and on excursions in the field.

1.ACORN, J. 2001. Tiger Beetles of Alberta, Killers on the Clay, Stalkers on the Sand. University of Alberta Press, Edmonton.

2.FUNG, K. 1999. Atlas of Saskatchewan. University of Saskatchewan, Saskatoon.

3. HUTCHINGS, G.E. 2004. Eight new species or previously unreported species of odonata (dragonflies) for Saskatchewan. *Blue Jay* 62(2): 98-103

4. HUTCHINGS, G.E. 2003. A list of the Odonata of Athabasca Sand Dunes Provincial Wilderness Park, Saskatchewan. *Argia, The News Journal of the Dragonfly Society of the Americas* 14(4): 5-8

5. HUTCHINGS, G.E. 2002. Three New Species of Odonata for Saskatchewan, Canada. *Argia, The News Journal of the Dragonfly Society of the Americas* 13(4): 5-7

6. JONKER, P. M. and J. S. ROWE. 2001. The Sand Dunes of Lake Athabasca, Your Adventure in Learning. University of Saskatchewan Extension Press, Saskatoon.

7. PAULSON, D. R., and S. W. DUNKLE. 1999. A checklist of North American Odonata, including English name, etymology, type locality, and distribution. Occ. Pap. Slater Mus. Nat. Hist., No. 56: 1-86.

8. PARKER, D. The Saskatchewan Aquatic Insect Pages. http://www.usask.ca/biology/skabugs/dragon/odonata.html. [Accessed March 30, 2004], 1999.

9. RONEY, K. and J. DUNCAN. 2000. Compiled List of The Odonata of Saskatchewan.

10. WALKER, E. M. 1955. The Odonata of Canada and Alaska. Vol. I. U. of Toronto Press., Toronto.

11. WALKER, E. M. 1958. The Odonata of Canada and Alaska. Vol. II. U. of Toronto Press, Toronto.

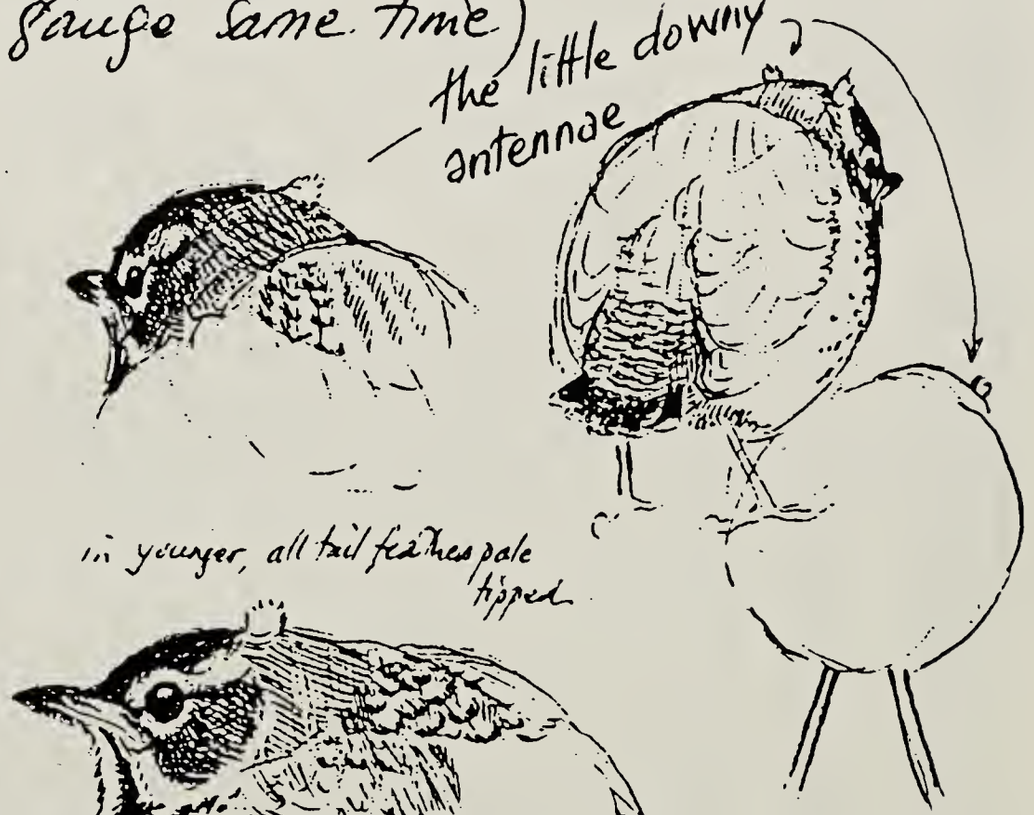
12. WALKER, E. M. and P.S. Corbet. 1975. The Odonata of Canada and Alaska. Vol III. U. of Toronto Press, Toronto.

ACTIVIST OPTIONS

Perhaps,
as only gophers can,
sensing our longing
to stick it to "the Man",
eliminate the eyesore,
the tiny rodent made its way
stealthily
guilelessly
through the chainlink,
with its ineffectual barbed wire topping,
and into the transformer,
into saboteur heaven,
onto the front page of the *Herald* (city section).
Yet the substation still stands:
featured view,
through the plants and stained glass,
of the living room
in which we sit snug,
lattes in hand,
listening to Handel,
admiring the ravens,
dwellers among the high girders,
who raise their young in high-tension safety,
daring the Man
to climb on up
and deconstruct
their nest of sticks among the stays,
and live to croak another day.

- Sandy Ayer

June 19 '92 sunny in midday → 20°C. Some heavy cloud; no rain in Avonlea. Sunny mostly in eve. C. Waxwings & robins at kit. crab & in yard. No sign of Mourning Doves. Wrens about, The ♀ in shed crab & also kit. crab (♀ because see & singing on fence in rain same time)



in younger, all tail feathers pale tipped

The juv. ball shape;

Two ages of yg robins about yd & under-window. Two individuals of each above age: The yonger smaller, c downy tufts behind ears, spherical shape, tails → 1 inch long?

The older (2 weeks?) longer, bigger; no down, tails → 2 inches long.

The yonger ones hop or bounce round about, moving position or following adult when one comes near. The older have begun to run as well as hop.

AQUATIC INVERTEBRATES

A NEW TADPOLE SHRIMP, *Triops longicaudatus*, IN SASKATCHEWAN

HENRY MANN, Sir Wilfred Grenfell College, Corner Brook, NL A2H 6P9
Email: hmann@swgc.mun.ca and M.V. S. RAJU, Suite 307, 477 Superior St., Victoria, BC V8V 1T5

While investigating plants and animals in the field, invariably unexpected observations will be made, sometimes related and sometimes unrelated to the original purpose. It is this fundamental feature of field biology that makes it an appealing and exciting pursuit for naturalists and scientists alike. Such was the case in the summer of 2000 while searching for charophytes, aquatic plants also known as "stoneworts", in ephemeral aquatic habitats of the Regina area. Stoneworts are complex large green algae with stems and branches that superficially mimic the structure of vascular plants. The rare Macoun's Nitella (*Nitella macounii*) as well as other stoneworts occur in these habitats.[5]

On July 19, 2000 we examined an inundated depression in a grain field on the south side of the Trans-Canada Highway about 0.6 km west of the Pinkie Road junction (Figure 1). Wading in the clear shallow water of such pools we could easily spot the bright green growth of charophytes which we collected by hand. This particular pool was only 30 cm deep and appeared ideal for the growth of stonewort species adapted to ephemeral habitats, however, a careful survey of the entire water body turned up only one tiny, somewhat stunted plant of Braun's Stonewort (*Chara braunii*). The substrate seemed to be different from other flooded depressions we had investigated, having a fibrous crusty covering which had obviously been dry before the pool was again inundated by summer thunderstorms.

Figure 1. Ephemeral grainfield pool with tadpole shrimp* Triops, *facing south from Trans-Canada Highway. ***Henry Mann***

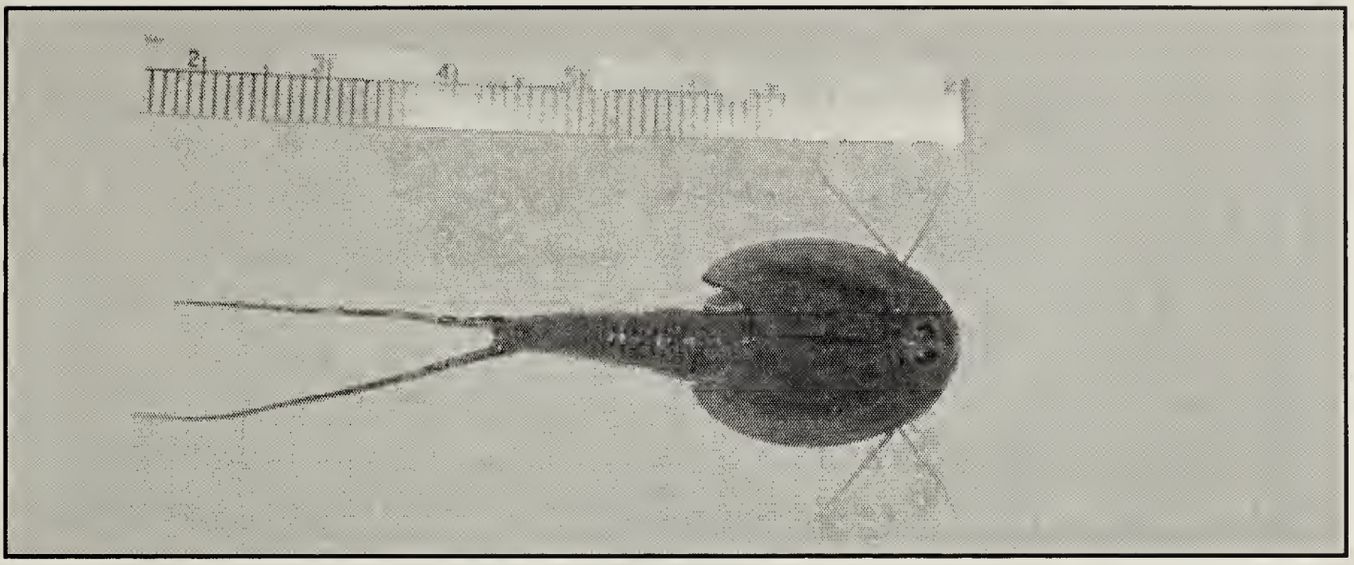


Figure 2. Dorsal view of tadpole shrimp,* Triops longicaudatus.** ***Henry Mann

Most surprising were the large, strange-looking animals that seemed to appear from nowhere and then quickly dart off, hiding themselves in the loosely flocculent substrate. They appeared to be very numerous. We had not seen anything like this before in the many dozens of shallow depressions previously investigated in this and previous years. Although difficult without proper equipment, we managed to capture one of the creatures which neither of us could recognize. It looked like a miniature marine horseshoe crab with a long jointed tail, almost prehistoric in appearance. So, along with the day's collection of stoneworts, our mysterious little beastie was whisked off to the laboratory for further examination.

Without too much difficulty we were able to determine the group to which the animal belonged: the tadpole shrimp, Crustaceans of the Order Notostraca. Identification to species would have to wait until the appropriate literature was acquired, but in the meantime we examined our unusual creature under the stereoscope. The crustacean was 6.5 cm long from its rounded head-thorax end to the tip of the two long tail spines (Figure 2). The anterior shell (carapace) was 1.8 cm wide and greyish-brown in color with two dark brown eye-spots near the front. Projecting from either side of the carapace were thin hair-like "feelers" (first thoracic appendages). On the underside could be seen many overlapping segments with gills which beat in rhythmic fashion. Its long tail-like abdomen was quite flexible, composed of jointed plates. The end segment, known as the telson, bore two long spines (caudal rami). At certain lighting angles, surfaces of the carapace and abdomen plates produced a slight iridescence. Figure 3 illustrates some of the gross structural features of the organism. Further perusal of the literature determined our specimen to be *Triops longicaudatus*.[4]

Four members of the Notostraca are known from Canada, one in the genus *Triops* and three in the genus *Lepidurus*, as indicated in Table 1.[1] *T. longicaudatus*, the only *Triops* in North America, ranges from Mexico to southern Canada, but only inhabits the drier western portion of the continent where desert and semi-desert conditions prevail. It can easily be distinguished from members of the genus *Lepidurus* all of which have a supra-anal plate on the last tail segment (the telson).[2] *Triops* does not (Figure 3). It appears that this report at the northern edge of its range is the first record for Saskatchewan. A preserved specimen is housed in the herbarium of the Sir Wilfred Grenfell College, Corner Brook, NL.

Few organisms utilize temporary pools, which dry out most summers, as their primary habitat. The major feature of tadpole

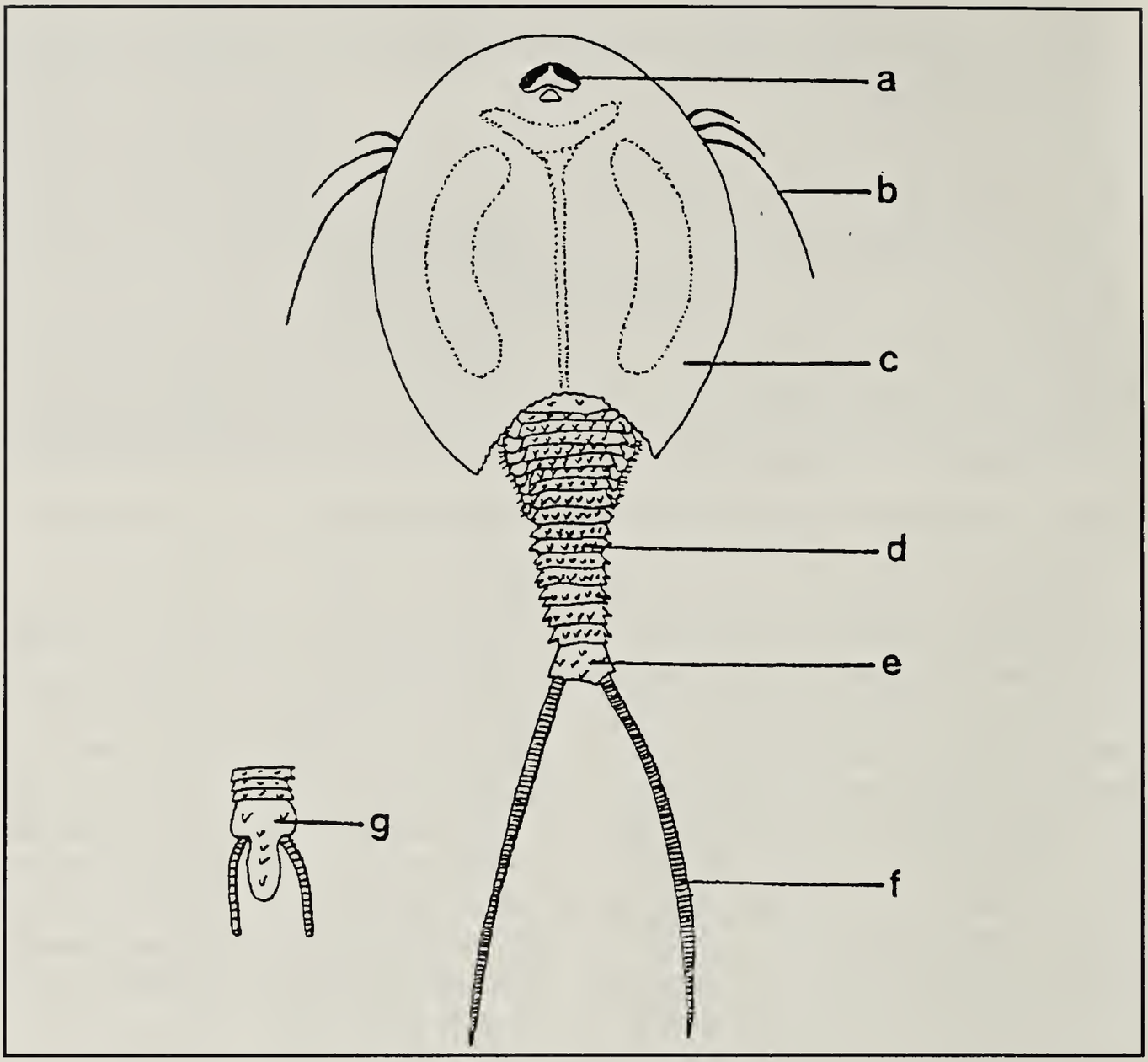


Figure 3. Dorsal diagram of* Triops *and its distinction from the genus* Lepidurus.** ***a. eye. b. first thoracic ("feeler") appendage. c. carapace of head and thorax. d. abdomen segment. e. telson. f. posterior spine (caudal ramus). g. telson of* Lepidurus *species with projecting supra-anal plate. ***Henry Mann***

shrimp which makes this possible is their drought-resistant eggs. Under ideal conditions dried eggs can remain viable for decades. Eggs are also the only means of dispersal. The crusty, almost papery-flocculent surface substrate of dried pools can readily be dispersed by high winds, especially whirlwinds (dust devils) so common in the dry west. Eggs are sticky when laid and easily adhere to waterfowl and shore birds. There is some suggestion that they may even be able to pass through the intestines of birds and still retain their viability.[3] A necessary adaptation to life in ephemeral ponds is a rapid life cycle, reported to be a mere 20-40 days in this species. The short life cycle and drought-resistant eggs have made tadpole shrimp very popular for laboratory culture, student projects, as aquarium pets, and their use as live fish food. Eggs can be purchased from biological supply houses or from various vendors on the Internet along with culture instructions. Regina residents now have a ready source simply by collecting a bit of substrate from this particular pool. Websites for information on *Triops* and *Lepidurus* species abound on the Internet, literally in the thousands!

While informing ourselves about the curious little creature, we quickly came to

Table 1. Species of tadpole shrimp known from Canada.[1]

Province/Region	Species
Alberta	*Lepidurus couesii* *Lepidurus lynchi* *Triops longicaudatus*
Saskatchewan	*Lepidurus couesii* *Lepidurus lynchi* *Triops longicaudatus**
Manitoba	*Lepidurus couesii*
Arctic Canada	*Lepidurus arcticus*

*current report

realize that stoneworts and tadpole shrimp have much in common. An aquatic plant and an animal have adapted in parallel ways to the same type of ephemeral habitat where few other species are present as competitors or predators. Tadpole shrimp have developed drought-resistant eggs passively dispersed by wind or on the bodies of waterfowl. Stoneworts have developed drought-resistant spores which can remain viable for decades in the dried state and which are dispersed in and on waterfowl, and in blown dust. Eggs and spores exhibit variable dormancy, not all germinating at the same time, some remaining viable and inactive for many seasons to ensure long-term survival in unpredictable temporary habitats. Both have rapid growth and short life cycles, and both are food sources for waterfowl thereby insuring contact with one of their major dispersal mechanisms. Both belong to groups going back hundreds of millions of years to the early beginnings of terrestrial life on this planet so they obviously have been enduringly successful despite the tenuous habitats they occupy.

We also suspect that there is a direct interaction between the two organisms which could be investigated in the future. Charophytes of temporary habitats tend to be small tender species and *Triops* is known to be a feeder on tender vegetation as well as on detritus and small invertebrates. This may well be the reason why this pool was almost totally devoid of stoneworts when they were present in other similar such pools without *Triops*. It has been shown elsewhere that certain stonewort species will be absent in water bodies that harbour high numbers of invertebrate herbivores such as amphipods.[6] Perhaps tadpole shrimp also modify the substrate with their papery/crusty egg masses which possibly may inhibit stonewort germination and growth.

Despite their low biodiversity, ephemeral pools provide unique habitats for species often not found elsewhere. These species have developed various adaptations to cope with variable, unpredictable and extreme conditions imposed upon them. The ecology of these waters and the species that inhabit them deserve a much closer look.

1. HARTLAND-ROWE, R. 1965. The Anostraca and Notostraca of Canada with some new distribution records. *The Canadian Field - Naturalist* 79:185-189.

2. LAWRENCE, J.R. 1975. Tadpole shrimps in Beaver Creek, Saskatchewan. *Blue Jay* 33(3):149-152

3. LONGHURST, A.R. 1955. Evolution in the Notostraca. *Evolution* 9: 84-86.

4. LONGHURST, A.R. 1955. A review of the Notostraca. *Bulletin of the British Museum (Zoology)* 3(1): 1 - 57.

5. MANN, H. and M.V.S. RAJU. 2002. First report of the rare charophyte *Nitella macounii* (T.F. Allen) T.F. Allen in Saskatchewan and western Canada. *The Canadian Field-Naturalist* 116(4): 559-570.

6. PROCTOR, V.W. 1999. Charophytivory, Playas y Papalotes, a local paradigm of global relevance. *Australian Journal of Botany* 47: 399-406.

A PRELIMINARY SURVEY OF AQUATIC MACROINVERTEBRATES COLLECTED FROM CROOKED LAKE FEN NATURE SANCTUARY IN SOUTHEASTERN SASKATCHEWAN

DALE PARKER, AquaTax Consulting, 1204 Main Street, Saskatoon, SK S7H 0L2
E-mail: dale.parker@sasktel.net

Introduction

Crooked Lake Fen Nature Sanctuary is located on the north bank of the Qu'Appelle River Valley at the junction of Highways 47 and 247 (102°-50'-27" W; 50°-38'-57" N).[20] Surveys of the birds, vegetation and lichens have been conducted previously for the sanctuary.[4,7] The present research focuses on the aquatic macroinvertebrates—invertebrates that live in water for at least part of their life cycle and are retained by a net with mesh openings of 0.2 to 0.5 mm.[22]

In the sanctuary, mineral-rich ground water seeps and at least two cold-water springs have formed a complex of wetland habitats[7] (Figures 1 and 2). Three tiny streams flow through the wetlands. Water from the wetlands and small streams flows down into a larger stream (#12 in Figure 1) that follows the edge of the sanctuary and ultimately empties into the Qu'Appelle River. On the east margin of the sanctuary (#4a in Figure 1, Figure 3) is a series of clear shallow pools with mineral deposits (marl) in and around them.

Methods

Samples were collected from the sanctuary on seven occasions from June 2000 to April 2005 (June 21, 2000, May 13 and September 28, 2001, July 23, 2002, August 13, 2003, October 10, 2004, April 23, 2005). Visits were timed to optimize the probability of collecting new macroinvertebrate taxa (distinct taxonomic groups) and different life stages to aid in identification. Habitats sampled included shallow pools, saturated soil and peat, and streams. Most of the sampling effort was concentrated on the stream (#12) and adjacent wetlands (#18, #19 and #20 in Figure 1).

Macroinvertebrate collections were made by sweeping a strainer with 0.5 mm mesh openings through the water and along bottom substrates (Figure 4). An aquarium net with 0.13 mm mesh openings was used as a drift net in the streams to collect dislodged macroinvertebrates. Submerged leaf litter, rocks and branches were examined for adhering macroinvertebrates. Collected material was placed in white pans and the macroinvertebrates were picked out and preserved in jars of 100% denatured ethanol. Adult aquatic insects were captured by sweeping with an aerial net. These were killed with ethyl acetate.

In the lab, a series of specimens of each type was picked from the samples and preserved in labeled vials of 75% denatured ethanol. Adult beetles, flies, and dragonflies were pinned. Genitalia of male beetles were dissected and mounted on points. Specimens of Chironomidae were dissected and mounted on microscope slides. Identifications were made with the aid of a stereomicroscope and a phase-contrast compound microscope while referring to the taxonomic literature. (See reference section for list of taxonomic references used.)

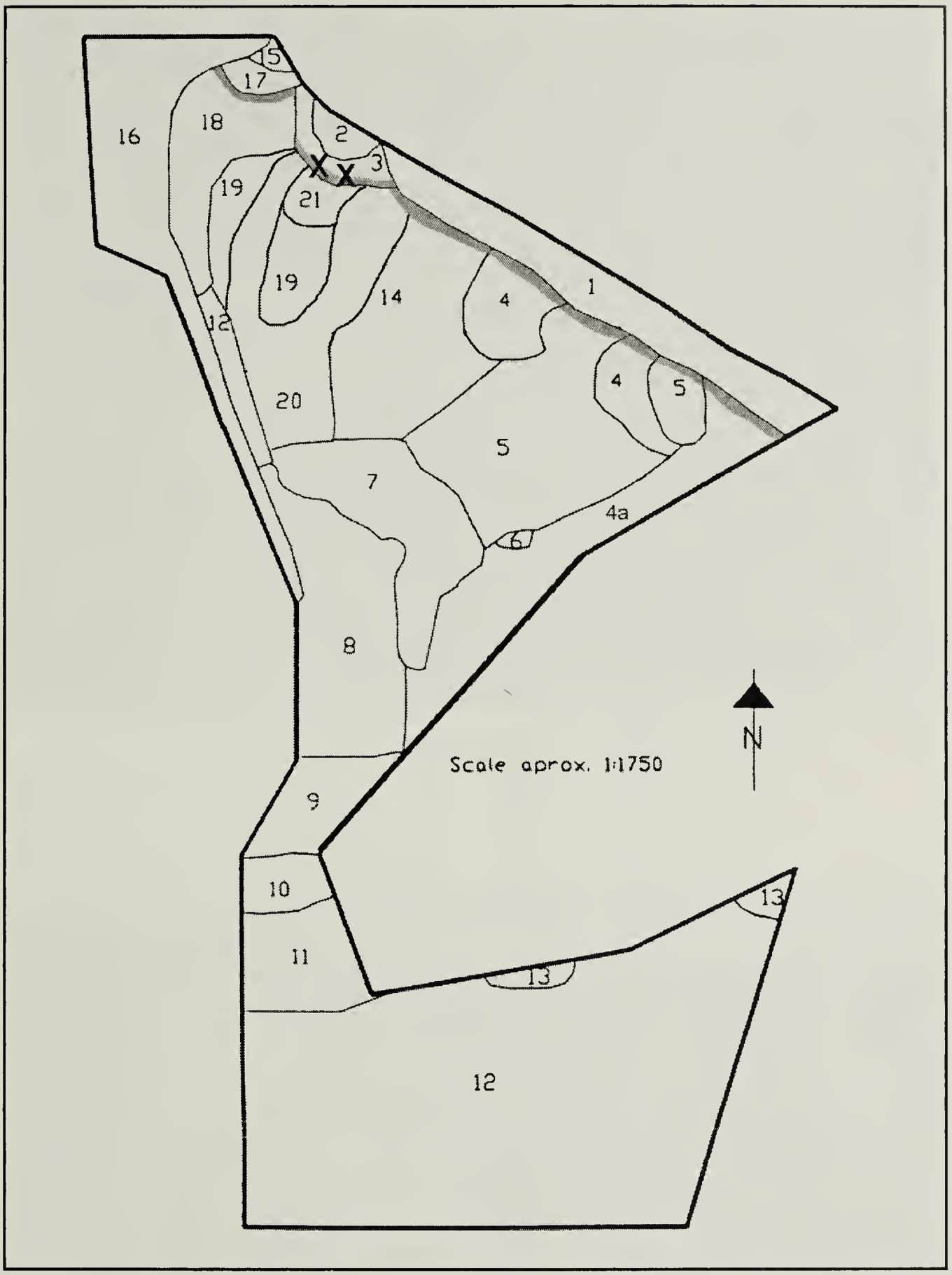


Figure 1: Ecological land classification and vegetation map of Crooked Lake Fen Sanctuary after Golder Associates[7]. Gray areas indicate zone of numerous ground water seeps. "X" indicates distinct springs. #1-Hardwood Forest, #2-Grassland, #3-Trembling Aspen Bluffs, #4 & #4a-Wet Marsh with calcareous pools, #5-Wet Marsh, #6-Damp Marsh, #7-Dry Marsh Edge, #8-Wet Meadow, #9-Wet Drainage Corridor, #10-Wet Meadow, #11-Wet Meadow, #12-Stream/Wet Marsh, #13-Wet Meadow, #14-River Birch Stand, #15-Brome Grass Meadow, #16-Manitoba Maple Forest, #17-Tall Shrub, #18-Wet Sedge* (Carex) *Fen, #19-Wet Cattail* (Typha) *Marsh, #20-Wet Giant Reed Grass* (Phragmites) *Marsh, #21-Wet Sedge Marsh with mineral soils below springs.

Figure 2: Vegetation immediately around a spring.

Air and water temperatures were measured on each visit. On October 10, 2004, stream water was tested for pH and conductivity using a Hanna HI98129 pH/EC/TDS meter.

Results and Discussion

Crooked Lake Fen Sanctuary habitats

Water temperature at the stream (#12, Figure 1), recorded approximately at noon on each visit, ranged from 11°C to 16°C and averaged 11°C cooler than the air temperature. On October 10, 2004, the stream water pH was 8.2 and conductivity was 2044 microsiemens/cm (1225 ppm dissolved solids). The alkaline pH and high conductivity of the water, the presence of marl and a peaty layer coupled with a high diversity of water loving plants[7] indicate areas #18, #19, #20 and #21 (Figure 1) have characteristics of 'extreme-rich' fens and marshes.

Fens and marshes are two of five classes of wetlands distinguished on the basis of water dynamics (fluctuations, flow, chemistry) and its influence on vegetation growth.[38,39] The other classes are shallow open waters, swamps and bogs.[38,39] Shallow open waters are characterized by aquatic plants that either float or live submersed in the water.[39] They occur in depressions in which large seasonal water fluctuations may occur. Swamps are well treed, with large fluctuations in water levels and water flow.[39] Marshes typically occur in poorly drained areas around sloughs and lakes or adjacent to flowing water. They may have extreme water fluctuations during the year. The substrate is mineral based but some marshes have a thin layer of partially decomposed vegetation or peat. The nutrient rich water produces lush vegetation including sedges (*Carex*), cattails (*Typha*) and bulrushes (*Scirpus*). Trees are generally absent.[38,39]

Bogs and fens are sometimes referred to as peatlands as they typically have a thick (>40 cm) peat layer.[38,39] Bogs are usually

associated with standing water. In some cases they receive only atmospheric water and have no ground water or surface water inputs.[39] They are very acidic (pH<4.7) and nutrient poor. The dominant vegetation is *Sphagnum* moss.[38,39]

Fens share characteristics of both bogs and marshes.[38,39] Fens usually have mineral-rich water flowing slowly through them. Three fen types—poor, moderate-rich, and extreme-rich—have been recognized based on water chemistry and vegetation characteristics.[39] Poor fens are most similar to bogs. They are acidic (pH<5.5), nutrient poor and dominated by *Sphagnum* moss. Due to limited decomposition, thick layers of moss-based peat develop, restricting water flow. Moderate-rich fens are not as acidic as poor fens (pH 5.5 to 7.0). Water flow is less restricted and decomposition is more complete than in poor fens, so more nutrients are available for plant growth. Usually sedges and brown mosses (Amblystegiaceae) are abundant. Extreme-rich fens are most similar to marshes. The water is alkaline (pH > 7.0) and may have high levels of dissolved minerals that form marl deposits. Decomposition occurs relatively quickly, slowing peat formation, improving water flow and increasing the amount and movement of nutrients. This results in extensive growths of vascular plants such as sedges (*Carex*), willows (*Salix*) and river and swamp birch (*Betula occidentalis*, *B. glandulifera*).[38,39]

Fens and cold streams are usually found in the boreal region and are not typical of the Saskatchewan prairies where aquatic habitats generally consist of temporary ponds, small marshy sloughs, man-made reservoirs, saline lakes, and warm meandering rivers and streams.[38] Thus the Crooked Lake Fen Sanctuary represents an unusual mix of habitats for the Saskatchewan prairies.

Macroinvertebrates

A total of 63 macroinvertebrate taxa were collected from the sanctuary during the study (Table 1). All but seven were insects. Flies (Diptera) made up 65% of the

Figure 3: Mineral pools in area # 4a.

Figure 4: Sampling stream in area # 20.

macroinvertebrates collected. The most diverse group was the non-biting midges (Diptera: Chironomidae) represented by 21 different taxa. Fifty-eight of the macroinvertebrates can be considered residents, as each was collected in the aquatic habitats or was likely "breeding" in the sanctuary. Five insect taxa were collected only as adults in aerial sweeps, suggesting they may be transients originating from the Qu'Appelle River or nearby ponds. The cumulative resident count graph, shown in Figure 5, has reached a plateau indicating the majority of macroinvertebrate taxa have been recorded based on the sampling methods used.

The macroinvertebrate list for the sanctuary includes the predatory leech (*Percymoorensis marmoratis* (Say)), the marsh pond snail (*Stagnicola elodes* (Say)), pea clams (*Pisidium sp* and *Sphaerium sp*) and scuds (*Gammarus lacustris* Sars), as well as skimmer dragonflies (Libellulidae), and many non-biting midges (Chironomidae) all of which are widespread in aquatic habitats of the Saskatchewan prairies. A number of insects were, however, unexpected. The stonefly, *Amphinemuma linda* (Ricker), is distributed throughout the boreal forest of Saskatchewan and Canada.[5,6] The mayfly, *Baetis brunneicolor* McDunnough, also inhabits streams in the boreal forest and Cypress Hills of Saskatchewan.[33] The caddisflies *Limnephilus rossi* Leonard and Leonard and *Hesperophylax designatus* (Walker) are found throughout northern Saskatchewan in springs and cold headwater streams.[28] *H. designatus* has also been collected from streams in the Cypress Hills and a spring south of Saskatoon.[28] The beetle, *Sanfilippodytes pseudovilis* (Young), is reported from across Canada usually in association with cold springs.[11] In Saskatchewan, it is recorded only from the boreal forest and Cypress Hills.[11] In addition to the above species, three non-biting midges, *Brillia retifinis* Saether, *Chaetocladius sp*, and *Diplocladius cultriger* Kieffer, collected at

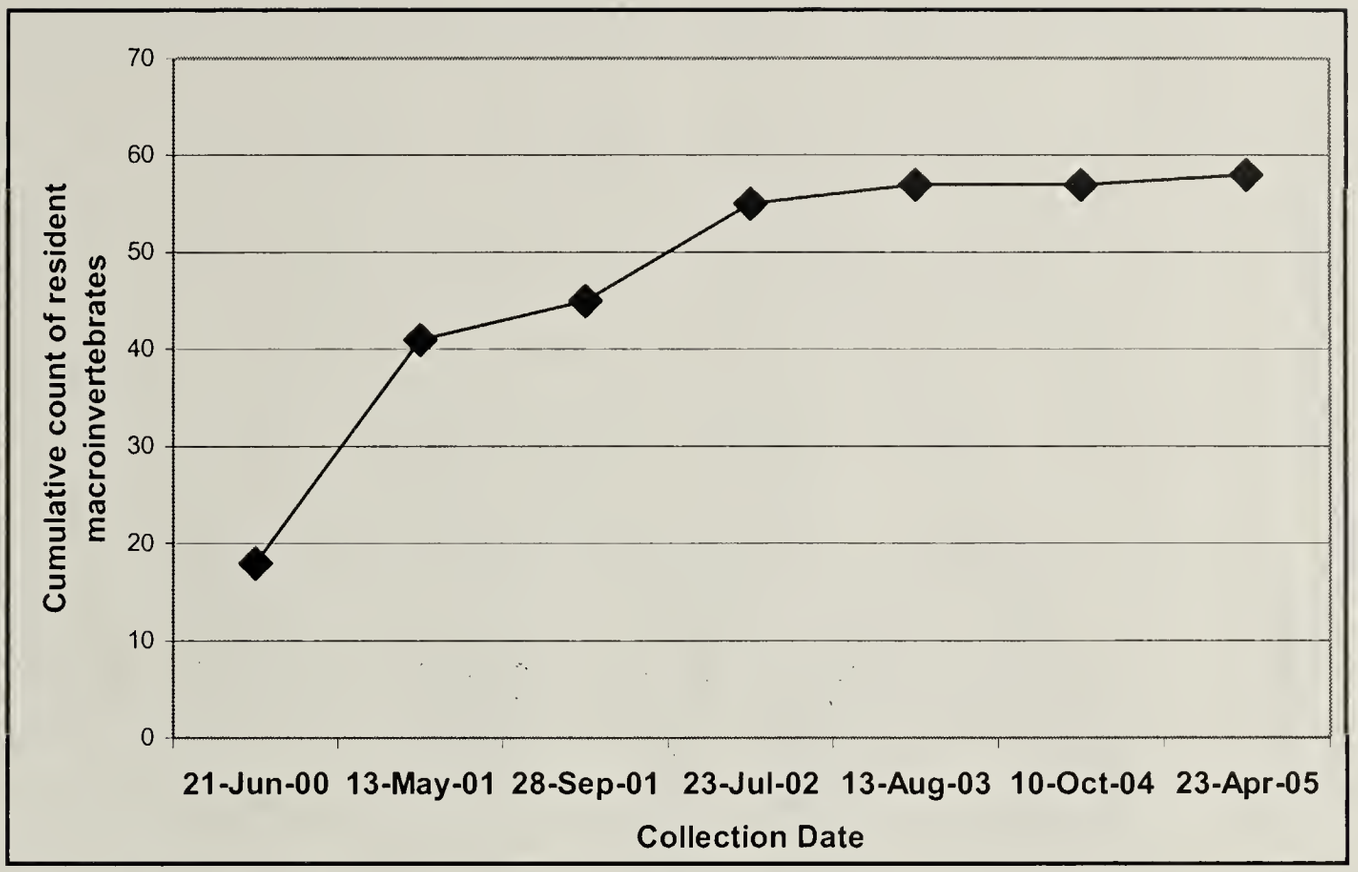


Figure 5: Accumulated resident count of macroinvertebrates collected at Crooked Lake Fen Nature Sanctuary.

the sanctuary have not previously been recorded in the province though their distributions suggested they should be present.[12,13,16] All are associated with cold springs and small streams.[34]

The macroinvertebrate communities of peatlands (bogs and fens) and springs have not been well studied in Saskatchewan or in Canada.[3,36] Most of the information currently available is based on incidental records associated with faunal surveys of various groups rather than studies documenting the entire macroinvertebrate community of a particular site.

Conclusions

Within its boundaries, Crooked Lake Fen Sanctuary contains groundwater seeps, springs, cool streams and areas of extreme-rich fen creating an unusual habitat complex for the southern Saskatchewan prairies. A number of aquatic insects typical of cold boreal forest streams occur here, outside their characteristic ranges. How these boreal insect populations originated at this location is open to speculation. They may be chance immigrants, although they are not exceptional fliers, or it is possible they are isolated relics of a time when more springs and/or cold-water streams were present in the area and these species were more widely distributed. The presence of these insects makes the sanctuary a significant zoogeographical site and worthy of continued protection.

The current study has attempted to begin documenting the aquatic macroinvertebrate biodiversity at the sanctuary. It is hoped that research will continue at the sanctuary using more intensive collecting methods, quantitative sampling devices and regular physical and chemical measurements. Such research will add new records and provide valuable information on community structure. Unfortunately, lack of species level taxonomic keys for most Saskatchewan aquatic macroinvertebrates continues to hamper such research in the province.

At present, direct risks to the sanctuary come from agricultural practices, acreage developments, or catastrophic events (i.e.

Table 1: Aquatic macroinvertebrates collected at Crooked Lake Fen Sanctuary

[R]=Resident, [T]=Transient

Hirudinea (Leeches)
Hirudinidae
Percymoorensis marmoratis (Say)[R]
Mollusca
Gastropoda (Snails)
Lymnaeidae
Pseudosuccinea cf columella (Say)[R]
Stagnicola elodes (Say)[R]
Physidae
Aplexa hypnorum (Linnaeus)[R]
Pelecypoda (Clams)
Sphaeridae
Pisidium sp[R]
Sphaerium sp[R]
Crustacea
Amphipoda (Scuds)
Gammarus lacustris Sars[R]
Insecta
Ephemeroptera (Mayflies)
Baetidae
Baetis brunneicolor McDunnough[R]
Odonata (Dragonflies and Damselflies)
Libellulidae
Sympetrum costiferum (Hagen)[T]
Sympetrum internum Montgomery[T]
Hemiptera (True Bugs)
Gerris buenoi Kirkaldy[R]
Plecoptera (Stoneflies)
Capniidae
Capniidae sp[R]
Nemouridae
Amphinemura linda (Ricker)[R]
Trichoptera (Caddisflies)
Hydroptilidae
Ochrotrichia cf spinosa (Ross)[R]
Lepidostomatidae
Lepidostoma sp[R]
Limnephilidae
Hesperophylax designatus (Walker)[R]
Limnephilus ornatus Banks[R]
Limnephilus rossi Leonard and Leonard[R]
Coleoptera (Beetles)
Dytiscidae
Agabus seriatus (Say)[R]
Liodessus obscurellus (LeConte)[R]
Sanfilippodytes pseudovilis (Young)[R]
Hydrophilidae
Crenetis cf digesta (LeConte)[R]

Table 1 Continued

Diptera (Two-winged Flies)
Ceratopogonidae (Biting midges)
Atrichopogon sp[R?]
Chironomidae (Non-biting midges)
Tanypodinae sp[R]
Procladius culiciformis (Linnaeus)[R?]
Diamesa sp[R]
Prodiamesa olivacea (Meigen)[R]
Orthocladiinae sp[R]
Brillia retifinis Saether[R]
Chaetocladius sp[R]
Corynoneura sp[R]
Cricotopus/Orthocladius sp[R]
Diplocladius cultriger Kieffer[R]
Eukiefferiela sp[R]
Orthocladius lignicola Kieffer[R]
Parachaetocladius sp[R]
Parametriocnemus sp[R]
Pseudosmittia sp[R?]
Thienemanniella sp[R]
Tvetinia bavarica group[R]
Tvetinia paucunca (Saether)[R]
Chironomus atrella (Townes)[R]
Micropsectra sp[R]
Micropsectra attenuata gr[R]
Culicidae (Mosquitoes)
Aedes cinereus Meigen[T]
Ochlerotatus spencerii (Theobald)[R]
Dixidae (Dixid flies)
Dixa sp[R]
Empididae (Dance flies)
Chelifera sp[R]
Clinocera sp[R]
Ephydridae (Shore flies)
Ephydridae sp[R]
Parydra sp 1[T?]
Parydra sp 2[T?]
Psychodidae (Moth flies)
Pericoma sp 1[R]
Pericoma sp 3[R]
Telmatoscopus sp[R]
Simuliidae (Blackflies)
Simulium vittatum complex Zett.[R]
Tabanidae (Horseflies and Deerflies)
Chrysops cf frigidus Osten Sacken[R?]
Chrysops fulvaster Osten Sacken[R?]
Hybomitra sp[R?]
Tipulidae (Craneflies)
Dicranota sp[R]
Liminonia sp[R]
Limnophila sp[R]
Pedicia sp[R]

oil or chemical truck spills). Unfortunately, the ground water source probably lies well beyond the borders of the sanctuary. Not only does this increase the risk of chemical contamination, but drilling of new water wells in the area could affect the natural flow pattern and chemistry of the sanctuary's ground water source. It may be possible to protect the sanctuary's water supply by monitoring its flow and quality enabling mitigation efforts to begin before impacts are irreversible. A more difficult problem to alleviate will be changes due to global warming which, undoubtedly, will affect the ground water supply and vegetation of the sanctuary.

Acknowledgements

The project was funded by research grants from SaskEnergy to Nature Saskatchewan. Thanks to Nature Saskatchewan and D. Peschken for initiating the research and securing funding. J. Halpin, V. Keeler and J. Webb assisted in field collections. J. Halpin sorted the samples. J. Webb verified the mayfly species and L. Dosdall assisted in the stonefly identifications.

1. CLARKE, A.H. 1981. The Freshwater Mollusks of Canada. National Museum of Canada, Ottawa.

2. CURRIE, D.C. 1986. An annotated list of and keys to the immature blackflies of Alberta (Diptera: Simuliidae). *Memoirs of the Entomological Society of Canada* 134:1-90.

3. DANKS, H.V. and D.M. ROSENBERG. 1987. Aquatic insects of peatlands and marshes in Canada: Synthesis of information and identification of needs for research. *Memoirs of the Entomological Society of Canada* 140:163-174.

4. DE VRIES, B. 2003. Lichen inventory of the Crooked Lake Fen Nature Sanctuary. *Blue Jay* 61:43-50.

5. DOSDALL, L.M. 1992. New records of Saskatchewan stoneflies (Plecoptera). *Proceedings of the Entomological Society of Manitoba.* 48:14-31.

6. DOSDALL, L.M. and D.M. LEHMKUHL. 1979. Stoneflies (Plecoptera) of Saskatchewan. *Quaestiones Entomologicae* 15:3-116.

7. GOLDER ASSOCIATES LTD. 1995. Report on the Crooked Lake Fen Avifauna and Vegetation Survey. Report prepared for SaskEnergy. 20 pp.

8. JOHANNSEN, O.A. 1933. Aquatic Diptera. Part I. Nemocera, exclusive of Chironomidae and Ceratopogonidae. *Cornell University Agricultural Experiment Station Memoir* 164: 70 pp

9. JOHANNSEN, O.A. and H.K. TOWNES. 1952. Guide to the insects of Connecticut. Part IV. The Diptera or true flies. Fifth Fascicle. Midges and gnats Tendipedidae (Chironomidae). *State Connecticut Geological and Natural History Survey Bulletin.* 80:1-147.

10. KLEMM, D.J. 1972. Freshwater Leeches (Annelida: Hirudinea) of North America. U.S. Environmental Protection Agency No. 18050. 53 pp.

11. LARSON, D.J., Y. ALARIE and R.E. ROUGHLEY. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. National Research Council Research Press, Ottawa. 982 pp.

12. MASON, P.G., and D.W. PARKER. 1994. Additions and corrections to the list of non-biting midges in Saskatchewan. *Blue Jay* 52:200-202

13. MASON, P.G., D.W. PARKER and P. MORRILL. 1991. An amateur naturalist's guide to non-biting midges in Saskatchewan. *Blue Jay* 49:174-182.

14. MERRITT, R.W. and K.W. CUMMINS. (Ed.) 1996. An Introduction to the Aquatic Insects of North America. 3rd Ed. Kendall Hunt Publishing Company, Dubuque, Iowa. 862 pp.

15. NEEDHAM, J.G., M.J. WESTFALL, Jr., and M.L. MAY. 2000. Dragonflies of North America. Revised Edition. Scientific Publishers, Gainesville. 939 pp.

16. OLIVER, D.R., M.E. DILLON, and P.S. CRANSTON. 1990. A Catalog of Nearctic Chironomidae. Canada Government Publications Centre, Ottawa. 89 pp.

17. OLIVER, D.R. and M.E. ROUSSEL. 1983. Redescription of *Brillia* Kieffer (Diptera: Chironomidae) with descriptions of nearctic species. *Canadian Entomologist* 115:257-279.

18. PARKER, C.R. and G.B. WIGGINS. 1985. The nearctic caddisfly genus *Hesperophylax* Banks (Trichoptera: Limnephilidae). *Canadian Journal of Zoology* 63:2443-2472.

19. PENNAK, R.W. 1989. Freshwater Invertebrates of the United States. 3rd Ed. John Wiley and Sons Inc., New York. 628 pp.

20. PESCHKEN, D.P. 2003. Wilderness preserved: Nature Saskatchewan's sanctuaries. *Blue Jay* 61:68-81.

21. ROBACK, S.S. 1980. The immature chironomids of the eastern United States. IV. Tanypodinae, Procladini.

Proceedings Academy Natural Science Philadelphia. 132:1-63.

22. ROSENBERG, D.M. and V.H. RESH. 1993. Chapter 1: Introduction to freshwater biomonitoring and benthic macroinvertebrates, p. 1-9. In: D.M. Rosenberg and V.H. Resh (eds.) Freshwater Biomonitoring and Benthic macroinvertebrates. Chapman and Hall, New York. 488 pp.

23. ROSS, H.H. 1944. The caddis flies, or Trichoptera, of Illinois. *Bulletin of the Natural History Survey Division*, IL. 23:1-326.

24. SAETHER, O.A. 1969. Some nearctic Podonominae, Diamesinae, and Orthocladiinae (Diptera: Chironomidae). *Fisheries Research Board of Canada Bulletin* 170:1-154.

25. SAETHER, O.A. and G.A. HALVORSEN. 1981. Diagnoses of *Tvetenia* Keiff. Emend., *Dratnalia* n. gen. and *Eukiefferiella* Thien., with a phylogeny of the *Cardiocladius* group (Diptera: Chironomidae). *Entomologica Scandinavica Supplement* 15:269-285.

26. SAWYER, R.T. 1972. North American freshwater leeches, exclusive of the Piscicolidae, with a key to all species. *Illinois Biological Monographs*.46:1-154.

27. SMETANA, A. 1988. Review of the family Hydrophilidae of Canada and Alaska (Coleoptera). *Memoirs Entomological Society of Canada* 142:1-316.

28. SMITH, D.H., 1984. Systematics of Saskatchewan Trichoptera Larvae with Emphasis on Species from Boreal Streams. Ph. D. Thesis. University of Saskatchewan, Saskatoon. SK. 1302 pp.

29. TESKEY, H.J. 1990. The Insects and Arachnids of Canada: Part 16: The Horseflies and Deerflies of Canada and Alaska. Diptera: Tabanidae. Agriculture Canada Publication 1838:1-381.

30. THORP, J.H. and A.P. COVICH. (Ed.) 2001. Ecology and Classification of North American Freshwater Invertebrates. 2nd Ed. Academic Press, New York. 1056 pp.

31. TOWNES, H.K. 1945. The nearctic species of Tendipedini [Diptera, Tendipedidae = Chironomidae]. *American Midland Naturalist* 34:1-206.

32. WALKER, E.M. and P.S. CORBET. 1975. The Odonata of Canada and Alaska. Vol. 3. Anisoptera-Macromiidae, Corduliidae, Libellulidae. University of Toronto Press, Toronto, Ontario. 307 pp.

33. WEBB, J.M. 2002. The Mayflies of Saskatchewan. M. Sc. Thesis. University of Saskatchewan, Saskatoon, SK. 375 pp.

34. WIEDERHOLM, T. (Ed.) 1983. Chironomidae of the holarctic region- Keys and diagnoses. Part 1. Larvae. *Entomologica Scandinavica Supplement* 19:1-457.

35. WIGGINS, G.B. 1977. Larvae of the North American Caddisfly Genera (Trichoptera). University of Toronto Press, Toronto. 401 pp.

36. WILLIAMS, D.D. and H.V. DANKS. 1991. Arthropods of springs: Introduction. *Memoirs of the Entomological Society of Canada* 155:3-5

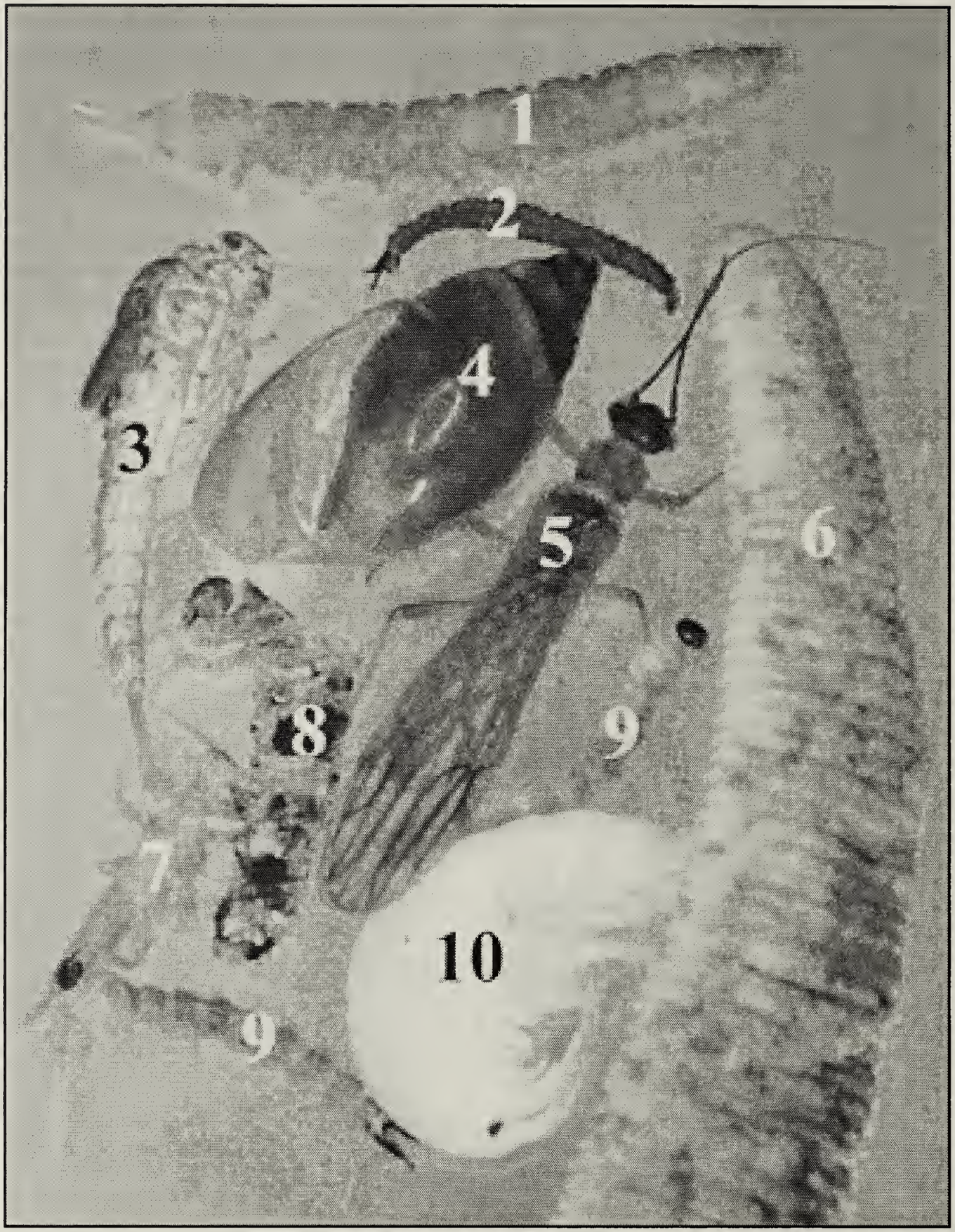
37. WOOD, D.M., P.T. DANG and R.A. ELLIS. 1979. The Insects and Arachnids of Canada: Part 6: The Mosquitoes of Canada. Diptera: Culicidae. Agriculture Canada Publication 1686:1-390.

38. ZOLTAI, S.C. 1987. Peatlands and marshes in the wetland regions of Canada. *Memoirs of the Entomological Society of Canada* 140:5-13.

39. ZOLTAI, S.C. and D.H. VITT. 1995. Canadian wetlands: Environmental gradients and classification. *Vegetatio* 118:131-137.

"Leafcutters are the dominant herbivores of the Neotropics, consuming far more vegetation than any other group of animals of comparable taxonomic diversity, including mammals, homopterans and lepidopterans."

Bert Hölldobler and Edward O. Wilson, *The Ants*, p.596.



Pictoral key to macroinvertebrate image on the cover

1. Cranefly larva (Diptera: Tipulidae: **Dicranota sp***)*
2. Moth fly larva (Diptera: Psychodidae: **Pericoma sp***)*
3. Mayfly larva (Ephemeroptera: Baetidae: **Baetis brunneicolor***)*
4. Polished Tadpole Snail (Gastropoda: Physidae: **Aplexa hypnorum***)*
5. Stonefly adult (Plecoptera: Nemouridae: **Amphinemura linda***)*
6. Predatory leech (Hirudinea: Hirudinidae: **Percymoorensis marmoratis***)*
7. Stonefly larva (Plecoptera: Nemouridae: **Amphinemura linda***)*
8. Caddisfly larva (Trichoptera: Limnephilidae: **Hesperophylax designatus***)*
9. Dixid fly larva (Diptera: Dixidae: **Dixa sp***)*
10. Scud (Amphipoda: Gammaridae: **Gammarus lacustris***)*

NOTES AND LETTERS

CRASH LANDING OF AMERICAN WHITE PELICANS

These are pictures I took on June 30, 2002. As you can notice, my dog isn't camera shy! This field on which about 50 dead pelicans were found was a mile east of Eyebrow, SK (NE 19-21-1 W 3rd). The results of the necropsy were consistent with severe trauma from impact with the ground (Trent Bollinger, Canadian Cooperative Wildlife Health Centre, Western College of Veterinary Medicine, Saskatoon, pers. comm.).

- *Nathan Nash*, Box 173, Eyebrow, SK S0H 1L0

[Sudden death of whole flocks of birds due to impact with the ground has been observed in wild geese on the prairies as well as in these pelicans. Some of these incidents, including this one, appear to coincide with severe local thunder storms, and they may be the result of a panic response by the birds to the sudden frightening noise combined with very poor visibility. The birds do not see the ground and fly into it at full speed when seeking escape. - Eds.]

Figure 1. American White Pelican that hit the ground flying

Figure 2. Some of the 50 pelicans found dead near Eyebrow

BLACK-BACKED WOODPECKER NESTS NEAR LA RONGE, SK

My first observation of the Black-backed Woodpecker nest was during our spring canoe trip, June 21 to 30, 2003. We arrived at our favourite island on Sulphide Lake, north of La Ronge, to set up camp on June 21. We had visited this location (N 55° 21' W 104° 53') many times previously. As we landed our canoe, I heard chattering from the nearest tree and realized that there was a nest, approximately six feet above the ground in a dead pine tree. (Figure 1) The adult woodpeckers arrived shortly to check on their brood. (Figure 2)

That evening, as we set up camp and cooked supper, we saw the adult birds flying back and forth to the mainland and bringing grubs to feed their noisy young. This continued the next morning. They were increasingly busy trying to meet the demands of the voracious young. The last time we saw the female adult was June 24. After that, the male alone was frantically feeding the babes.

As the young got bigger, they began poking their heads out of the nest. (Figure 3) At first they scolded us soundly, but, later became accustomed to our presence as their parents had.

On June 29, I awoke to a noisy chattering and peeling of bark in the trees above our tent on the higher side of the island. Crawling out of the tent, I had a marvelous surprise: the male adult and two of the young were up in the trees. They had fledged! The adult was teaching the young to search for grubs under the bark (Figure 4). When I went down to where our landing site and food preparation area were, I heard a chattering still from the nest tree and realized that not all had fledged! One young woodpecker was left behind. During the next 24 hours, the adult male came back occasionally to feed this little one, but he was left alone for long periods. We could only hope that he would soon find his wings! When we left the island to return home on June 30, this last babe had not yet fledged.

We returned to the island in late August for our second canoe trip of the year. On the morning of August 29, as I sipped coffee, a family of four Black-backed Woodpeckers flew to one of the trees near our canoe landing spot. They peeled some bark and fed briefly before moving on. I like to think that this was our family from the spring.

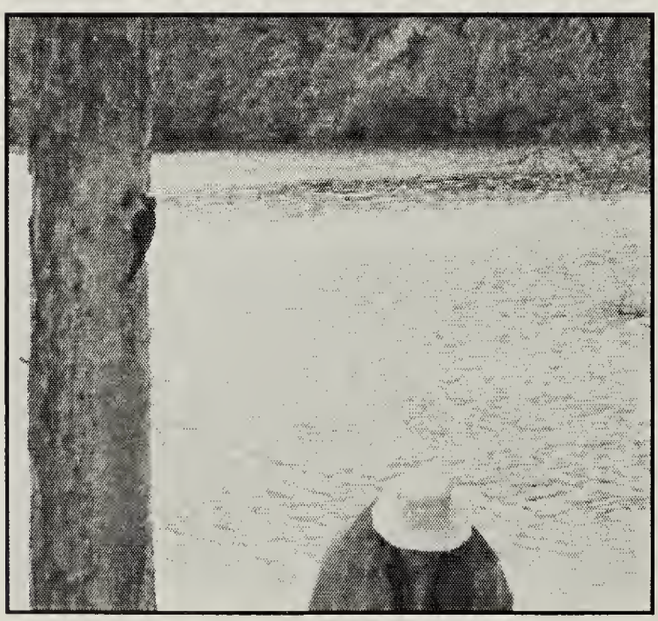


Figure 1.

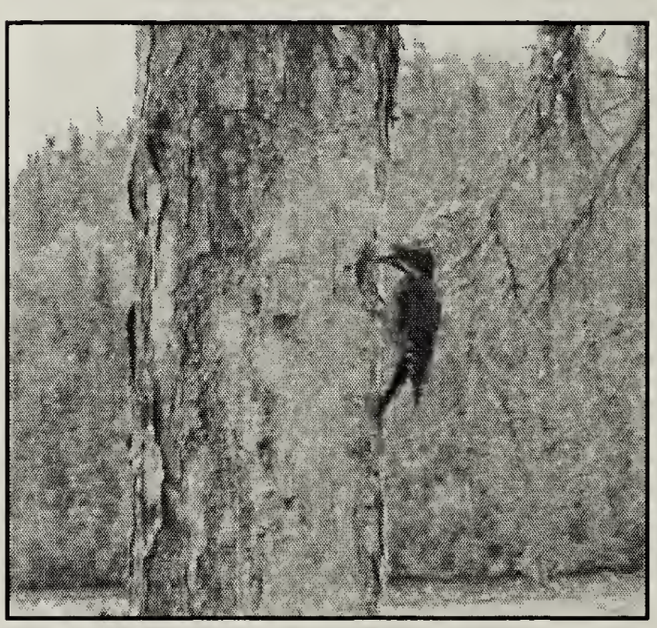


Figure 2.

Figure 3.

Figure 4.

We returned to our island in 2004. On arrival on June 3, we saw that the Black-backed Woodpecker nest of the spring before had been taken over by flickers, which had enlarged the nest cavity. Where were our Black-backed Woodpeckers? On June 6, I finally spotted a female, and then the male, up the hill. Watching their movements, I was able to locate their new nest site. A fire had gone through the higher part of the island the fall previous. This nest was about five feet above ground in one of the burned trees. (Figure 5) The eggs had not hatched by the time we left the island on June 12.

We returned for our second trip in late August, 2004. Again I observed family groups of Black-backed Woodpeckers and assume that they had successfully raised another brood.

- *Oney Pollock*, Box 506, Canora, SK S0A 0L0

[These are the eighth and ninth nest records for Black-backed Woodpecker nests in Saskatchewan, and this is the only site with nests recorded in two consecutive years. Locations and dates of previous nests are Kazan Lake (1942), Cluff Lake (1982 in a burned Jack Pine), Shoal Lake (1990 in a fire-killed spruce), Weekes (1991 in an Aspen stump), Turtle Lake (1995), Little Bear Lake (two nests in 1998 both in burned Jack Pines). - Eds.]

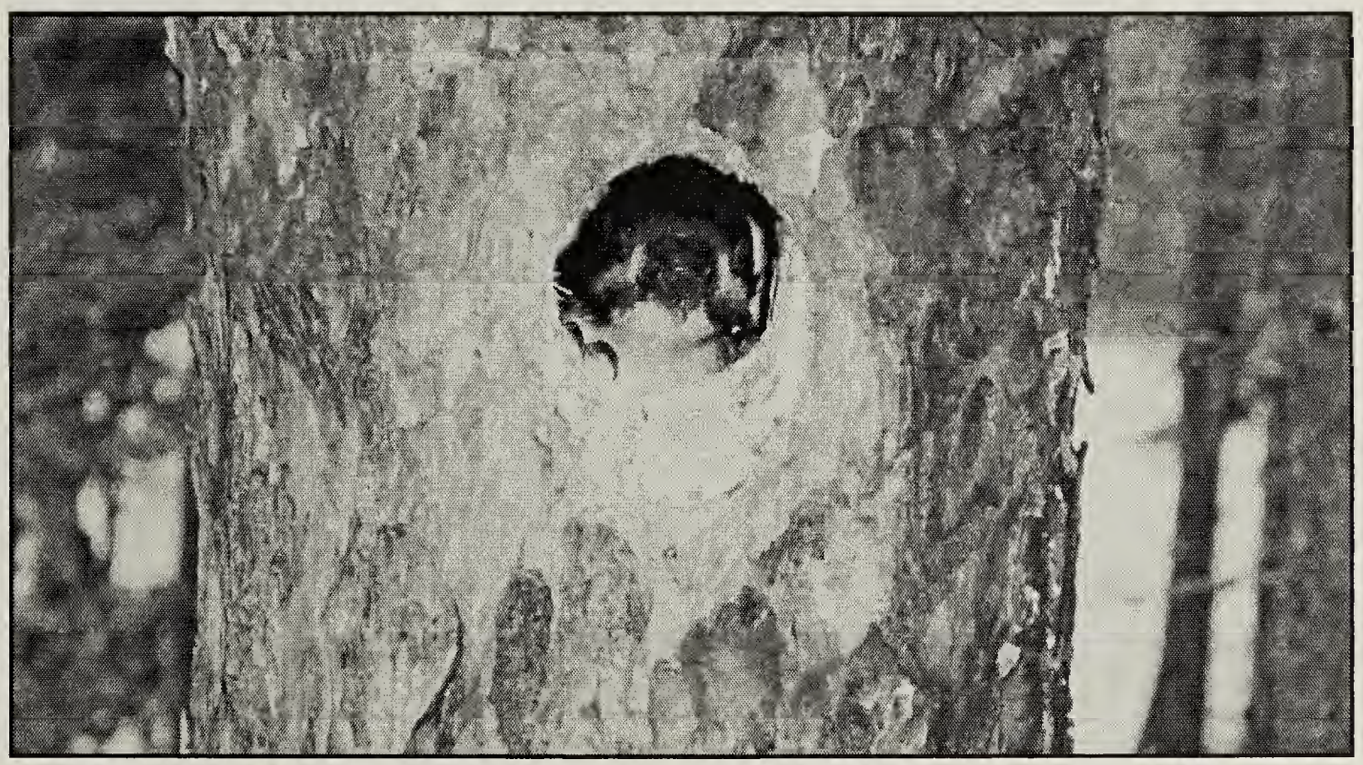


Figure 5.

SPRING ENCOUNTERS WITH LONG-EARED OWLS

Near dusk on March 29, 2005, while I was gathering a load of firewood in my back yard in the Charleswood area of Winnipeg, my attention was drawn to an unusual 'chittering' call coming from the trees towards the rear of our well-wooded property. The strange sound, an oscillating tremolo, lasted for about 15 to 20 seconds and seemed to originate from the woodlot canopy. The outer branches of a spruce tree were shaking violently against a Wood Duck nest box mounted at a height of about 4m on the trunk of a large trembling aspen. I glimpsed a crow-sized bird flying off the back of a second similar bird. The latter remained perched for a second before also flying away. I surmised that I had just observed mating behaviour that ended with copulation.

I strode to the back of the property where both birds had flown and observed a Long-eared Owl perched on an aspen branch where it had just landed. The owl turned to face me, then stretched up into an elongated pose and remained motionless for a couple of minutes. Bob Nero's photo of a tame Long-eared Owl gives a fair idea of that upright display. I went back to the house and about 20 minutes later, when I returned to the back yard, I heard a male Long-eared Owl's distinctive advertising song; another owl called softly in the distance.

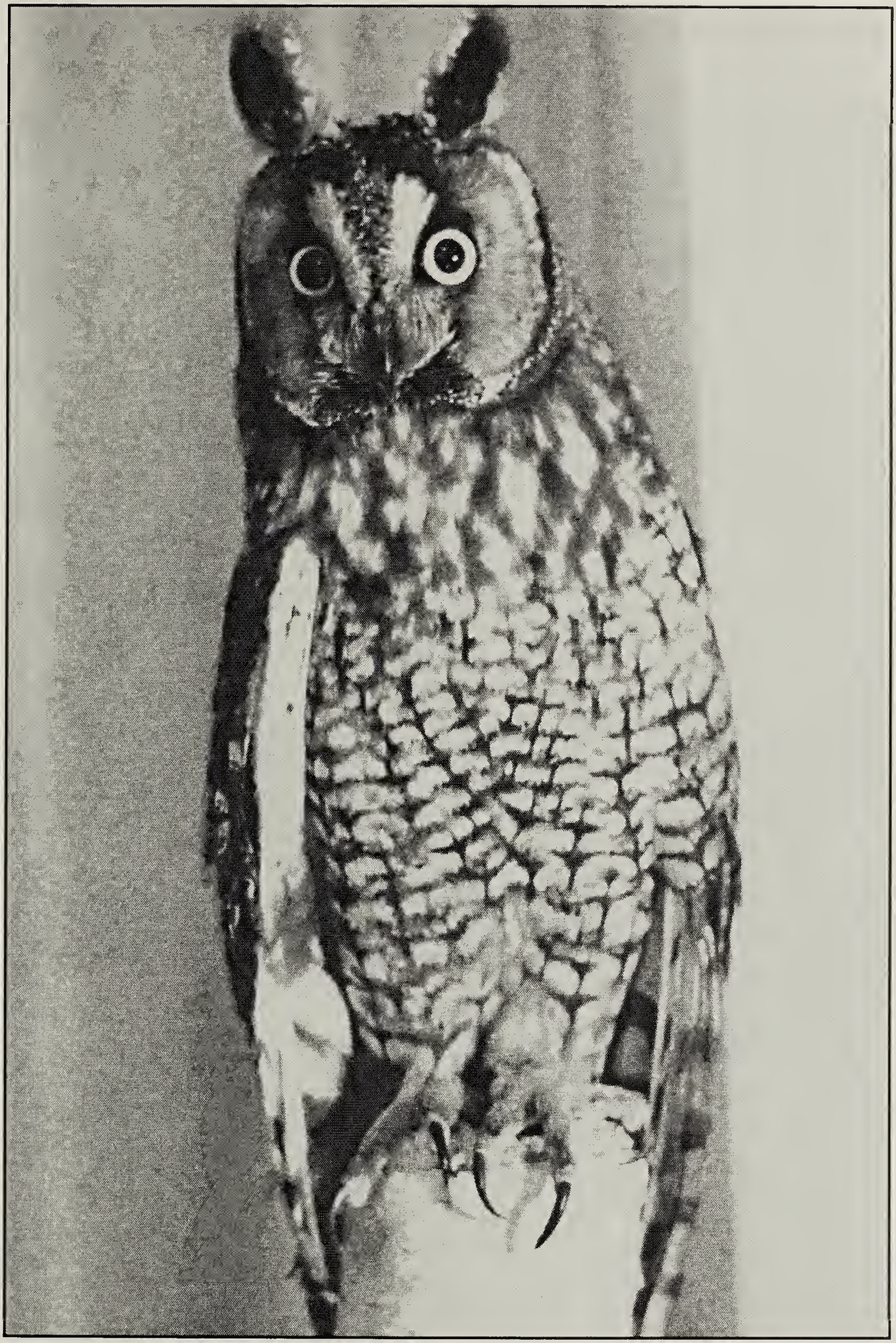
In early April, Craig Hammett, a neighbor across the street, told me that for several nights in a row, a large bird had been flying over his yard, and that this bird frequently made loud, 'wing-clap like' sounds at around 11:00 p.m. This may have been a Long-eared Owl. Males perform courtship flights over suitable nesting habitat and both sexes are known to wing-clap, a display presumably used in courtship and agonistic encounters.[2] Although I have not since seen or heard a Long-eared Owl in my yard, I presume that this pair is now nesting somewhere nearby.

I discussed the possibility of this pair nesting in, or being attracted to, a cavity such as in my Wood Duck nest-box, with my friend and neighbour Bob Nero. Although Long-eared Owls usually nest in old nests, such as American Crow or Black-billed Magpie nests, they have been known to nest in cavities in trees or cliffs, or even on the ground.[2] I was unable to find any literature that supported whether or not Long-eared Owls have ever nested in artificial nest-boxes. It should be noted that in Manitoba, Long-eared Owl "egg dates range from 13 April to 27 June, with the majority in May and early June." [1]

1. MANITOBA AVIAN RECORDS COMMITTEE. 2003. The Birds of Manitoba. Manitoba Naturalists Society, Winnipeg, MB.

2. MARKS, J.S., D.L. Evans and D.W. HOLT. 1994. Long-eared owl (*Asio otus*). *In* The Birds of North America, No. 133 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia.

- *Robert Berger*, 807 Coventry Road, Winnipeg, MB R3R 1B8



Long-eared Owl ***Bob Nero***

SHARP-SHINNED HAWK HITS WINDOW

On Sunday, January 11, 2004, while having lunch in the kitchen, we heard a noise from the front of the house (facing south) which I took to be a door being blown shut by wind. I live in Haysboro, a neighbourhood with many mature trees in southwest Calgary only a few blocks east of Heritage Park and Glenmore Reservoir.

On investigation, I noticed a large bird standing motionless on the front step. The bird was visible through a glass storm door and I observed the bird for several minutes. First it blinked its eyes and then slowly turned its head from side to side as if in a daze. After some slight body movement, it hopped over to the three steps and down to the path, leading me to think it was as yet unable to fly. Then it picked up a small bird that had been lying out of my line of sight and, once it had secured the bird, it flew off.

Reflecting on the incident, I realize that there had been two thumps, one smaller and one larger, in quick succession. My guess is that the hawk had been chasing a sparrow that flew into the storm door. I identified the hawk as a Sharp-shinned Hawk from *Birds of Calgary* (p.46) and the prey as a House Sparrow. The bird, a little larger than a magpie, was facing me at about 45° and resting back on a squarish tail, so the most significant feature that I saw was the light brown and white stripes on the breast.

- *Ian Sandilands*, 16 Holden Place SW, Calgary, AB T2V 3E5

Juvenile Black-crowned Night-Heron near the Bessborough Hotel along the South Saskatchewan River in Saskatoon, September 2004 ***Eric Hedlin***

MORE TIPS ON PREVENTING WINDOW COLLISIONS

Many times I have read from your distressed readers about birds flying into windows. Our deck windows reflect the trees in the yard and after many unsuccessful attempts at hanging strings, we were successful by inserting small cup hooks into the window sill 7 inches apart, and offsetting the top cup hooks into the window casing 7 inches apart and stringing plastic binder twine between the hooks. The strings are removed for window washing and then replaced. We have three large windows (5' 6" by 4') and the strings are quite unobtrusive to our viewing. [A version of this string technique was described by Peter Jonker in the June 2001 issue of *Blue Jay*. - Eds.]

- *April Sampson*, 417- 5th Avenue S.E., Weyburn, SK S4H 1Y4

Flora Obscura: *snapshot of identifying a rare plant. Since rare plants can't be picked, the field botanist has to bring the laboratory to the plant. This involves heavy books, small magnifiers, careful consideration of where to sit, and often, patient staring at an unremarkable, immature or even dead plant. On some days, the only warmth available is from heated discussions with fellow botanists. Why then is field botany one of the best careers? The thrill of discovery, the prairie wind that carries your conversations and the beauty in that unremarkable plant. Jennifer Neudorf, (© Enviroment Canada, 2004)*

NATURE LIBRARY

WHITE AS A GHOST: WINTER TICKS AND MOOSE

BILL SAMUEL. 2004. University of Alberta. Federation of Alberta Naturalists, Volume 1, Natural History Series. v + 100 pp. Hardbound, 22 cm x 28 cm.

There are a number of books on ticks and tick-related issues, most of which are packed with scientific facts and detail, which make them excellent resource books but not the sort of book you might consider as bedtime reading. By contrast, this book is one that will appeal to a wide audience: the natural history buffs, hunters, livestock producers, scientists, anyone who has been curious about ticks. This is a story about the relationship between one species of tick, the winter tick or moose tick, and its primary host, the moose.

The fact that this book is about just one species of tick is unusual enough; I can't think of another book like it in that regard. In addition, much of Bill Samuel's treatment of the winter tick is a first-hand account of what he and his students, as well as others, have found during decades of exploring the intricacies of the winter tick/moose interaction. For that reason, I specifically appreciated some of the hypotheses presented. Interactions between parasite and host are complex and not all of the answers are known.

The book begins with an introductory chapter on ticks and specifically on the winter tick and moose. The following five chapters explore the nature of the winter tick, including a history of outbreaks, intimate details on its life history, adaptations to acquiring its hosts, factors affecting their success in infestation and ultimate survival, and the impact on moose. The tick-moose interaction is a two-sided struggle, however, and in the next two chapters the author elaborates the defensive strategies of moose in the face of this extraordinary challenge of infestation. He even explores interactions with other important parasites of moose, including meningeal worm and liver flukes. For game managers, there is a chapter on some of the approaches to reducing impact of winter ticks. There is also a short appendix that presents methods used to calculate the impact of these ticks. All citations are fully referenced at the end of the book, for those who wish to explore the subject in greater detail.

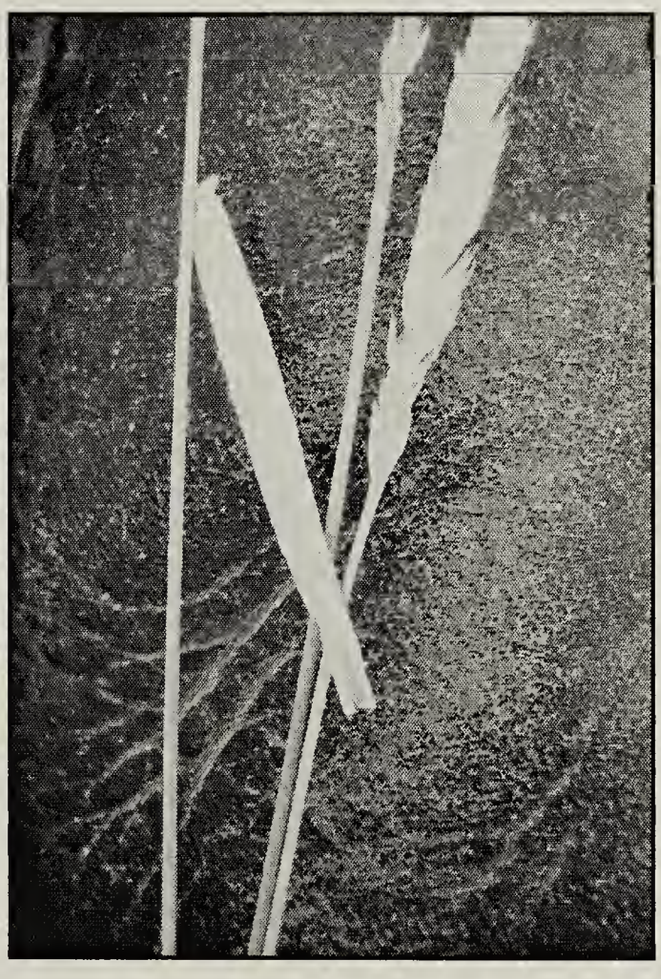
This relatively large format, handsomely-bound book is filled with colour photographs and illustrations. The massive clump of tick larvae assembled on the tip of a grass blade shown at the beginning of Chapter 4 leaves little doubt about how moose can acquire an infestation of tens of thousands and even more than 100,000 ticks. The close-ups of ticks and the impact that they cause in moose are some of the best photos I have seen of these topics. Only occasionally is a photograph enlarged beyond its resolution resulting in a moderately grainy appearance, for example, the full-page figure of a dense aggregation of feeding ticks on page 32. The text itself is well balanced, clearly written, and informative, without being overly technical. For the person who longs for specific data on this relationship, there are numerous tables and figures in which the author has substantiated his observations as presented in the text. The author has offered readers a broad palette of information that is factual, contains historical perspective, and is fascinating.

Reviewed by Terry D. Galloway, Department of Entomology, Faculty of Agricultural and Food Sciences, University of Manitoba, Winnipeg, Manitoba R3T 2N2

MYSTERY PHOTO

JUNE MYSTERY PHOTO

The animal that made these tracks is about three inches long. What is it and what was it doing?



ANSWER TO THE MARCHMYSTERY PHOTO

Blue Jay was not flooded with answers about the March mystery object. Perhaps this is another one of those odd things seen by field biologists when they are looking for something else (as mentioned in the tadpole shrimp article), but otherwise not generally encountered. That the object might be the case of a case-bearing moth was first suggested to us by Don Buckle and following that lead, with help from the on-line entomological community, we contacted Jean-François Landry, Curator, Canadian National Collection of Insects and Arachnids in Ottawa, who provided the information presented below. We would like to thank all those who guided this inquiry, and Dr. Landry for identifying the mystery object

and for the information about this group of moths. We'd also like to thank Michelle Lanoie for taking the photograph and making it available to *Blue Jay*. - Eds.

This is a *Coleophora* larval case. *Coleophora* is a genus of small moths known as the case-bearers. The larva constructs a case, such as the one shown here, to live inside and feed from. Most species are leafminers, that is the larva eats out a small circular hole underside a leaf where it attaches its case and from there eats out a small botch mine. Also many species are specialized seed feeders, cutting out a hole in the seed of their host plant and emptying out its contents, often using hollowed seed hulls as building bases for their case. The cases may afford some degree of protection, from the weather certainly, but not from parasites because they are heavily parasitized by hymenopterous parasitoids. The mature larva attaches the case to a fixed object such as a nearby plant and pupates inside it. The adult moth emerges a few weeks to several months after the case has settled. Many species overwinter as mature larvae in their case and adults emerge the following summer

The species of *Coleophora* cannot be identified based on this photograph. In the West there are a number of undescribed species that make this kind of case, the larvae are usually on composites (Asteraceae) and feed when the plants are young in the spring until about late May to mid-June. Adults fly in July or early August. I have reared a couple of them from Golden-Aster (*Chrysopsis*) and Snakeweed (*Gutierrezia*). Another potential good host for these is gumweed.

Coleophora is one of the largest genera of Lepidoptera with a current species count at nearly 1500 in the world and numerous undescribed species awaiting naming and cataloguing by taxonomists.

What bird is this? This photo was taken at Last Mountain Bird Observatory, May 30, 2005 by Robert Wapple. The answer will appear in the September issue.

MEMBERSHIP APPLICATION FORM

☐ New Member ☐ Renewal

Name (please print) .....

Address .....

City ..... Prov ..... Postal Code .....

Phone ..... Fax ..... E-Mail .....

☐ Change of Address: Please write in new address above

☐ Gift Membership:

Name (please print) .....

Address .....

City ..... Prov ..... Postal Code .....

Phone ..... Fax ..... E-Mail .....

Category	One Year	Three Year	Five Year
Individual	☐ $25	☐ $65	☐ $95
Family	☐ $30	☐ $75	☐ $115
Student	☐ $15		
Senior (>64 years)	☐ $20	☐ $50	☐ $75
Outside Canada	☐ $30	☐ $75	☐ $115
Institutional	☐ $30		
Life	☐ $600		

I wish to make a tax creditable donation to Nature Saskatchewan:

☐ General Programs $ _____

☐ Grasslands Trust Fund $ _____

☐ Last Mountain Bird Observatory $ _____

Fee Total

Nature Saskatchewan Membership $ _____

Nature Saskatchewan Donation $ _____

TOTAL $ _____

I would like to pay by: ☐ Cheque ☐ Visa ☐ Mastercard

Cardholder's Name: _____

Credit card number __/__/__/__/__/__/__/__/__/__/__/__/__/__/__/__/

Expiry date __/__/ __/__/ Signature _____

Make cheques and money orders payable to NATURE SASKATCHEWAN.

Mail to: Nature Saskatchewan
206 - 1860 Lorne Street
Regina, Saskatchewan S4P 2L7

* ***Do you know*** of any person interested in natural history and conservation who does not receive the *Blue Jay*? Please send their name and address and we will send a sample *Blue Jay* and an invitation to join our Society.

Renew by Phone!
Call toll-free: 1-800-667-4668 (Saskatchewan only) or (306) 780-9273
Fax (306) 780-9263
to renew by Visa or Mastercard

THIS ORGANIZATION RECEIVES FUNDING FROM:

NATURE SASKATCHEWAN

206-1860 Lorne Street, REGINA, SASKATCHEWAN S4P 2L7
PHONE: (306) 780-9273 or
TOLL FREE 800-667-4668 in Saskatchewan only
FAX: (306) 780-9263
E-MAIL: info@naturesask.ca
WEB: www.naturesask.ca

Publication Mail Agreement # 40063014
Return Undeliverable Canadian Addresses To
Administration Centre Printing Services
111-2001 Cornwall Street
Regina, SK S4P 3X9
Email: adminprint@sasktel.net